RADIO and ELECTRICAL Review

TELEVISION - COMMUNICATIONS - SERVICE - SOUND

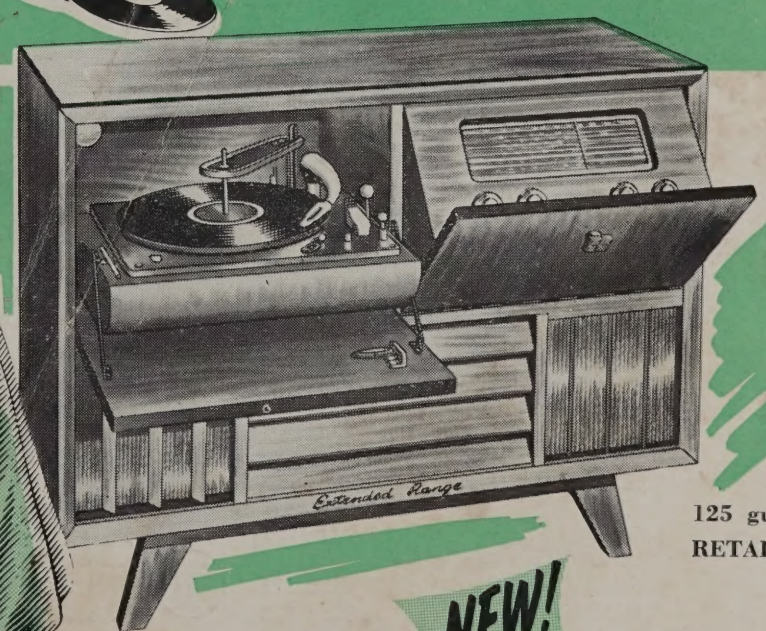
PRICE 2/3

VOL. 12, NO. 2 APRIL 1, 1957 Incorporating "RADIO and ELECTRONICS"

A NEW THRILLING NOVOSONIC RADIOGRAM WITH

contemporary Swedish styling . . .

beautiful "summer gold" finish!



125 guineas
RETAIL

NEW!

PHILIPS *Stockholm*

RADIOGRAM

★ *9-Valve performance from 6 power-packed multi-function valves.*

★ *Spread-band tuning; world-wide reception.*

★ *Philips famous all speed, all record size automatic changer.*

PHILIPS

PHILIPS ELECTRICAL INDUSTRIES OF NEW ZEALAND LIMITED

STANDARD TELEPHONES and CABLES PTY. LTD.

AUCKLAND Box 571 — WELLINGTON Box 593
CHRISTCHURCH Box 983 — WANGANUI Box 293

Radio and Electrical Review

VOL. 12, NO. 2 APRIL 1, 1957

Official Journal of
The New Zealand Electronics Institute (Inc.).
The New Zealand Radio and Television Manufacturers' Federation.
The New Zealand Radio and Electrical Traders' Federation.
New Zealand Radio, TV, and Electrical Traders' Association (Inc.).

Managing and Technical Director:
W. D. FOSTER, B.Sc.

Subscriptions:
2s. 3d. per copy; 27s. per annum, posted.
Advertising Rates supplied on application.

CORRESPONDENCE
All correspondence and contributions should be addressed to:
The Editor,
"Radio and Electrical Review",
P.O. Box 6361,
Wellington, New Zealand.

OFFICES AND LABORATORY:
Radio and Electronics (N.Z.) Ltd.,
48 Abel Smith Street, Wellington.
Telephone, Wellington, 50-660.
Telegrams and Cables:
"Radel", Wellington.

SOLE ADVERTISING REPRESENTATIVES for THE UNITED KINGDOM:
Cowlishaw and Lawrence (Advertising), Ltd., P.O. Box 656, 14–16 Ludgate Hill, London, E.C.4. Telephones: City 3718.
Cables: Cowlawads, London.

Contents

	Page
Editorial	2
A Home-built Transistorized Microphone	20
Publications Received	23
A Novel Inter-com. Switching Arrangement	24
Australian TV Received in New Zealand	27
High-quality Broadcast-band Reception	30
New Tubes and Transistors: A New Series for Car Radios	36
Missing and Stolen Radios	37
Standards for Electrically Heated Blankets	38
The United Kingdom's Radio Exports	39
New Products: Latest Releases in Electrical and Electronic Equipment	40
Air-ground Link for Private Airlines, by Maria Boldini, B.A., Dip.Ed.	42
Half-yearly Import Figures	43
Latest Overseas Developments	44
Wellington Branch of N.Z.E.I. (Inc.) Television Project	46
TV Round the Globe	47
John Gray's Record Page	48
"R. & E.'s" Hit Parade Lists	49
Personality Parade	55

Sole New Zealand Distributors: Gordon & Gotch (N.Z.) Ltd., Wellington

PRINTED BY HARRY H. TOMBS LTD., WINGFIELD STREET, WELLINGTON

Standard Specifications And Their Application

Elsewhere in this issue will be found an article concerning electrically heated blankets, and their compliance or otherwise with a standard specification. This opens up the whole question of standardization and its value to the trade and to the community at large.

Now that New Zealand has a Standards Institute, considerable use is being made of it and its work in a number of fields. The application of a standard specification to electric blankets is somewhat of a live issue since a report was published in the daily newspapers throughout the country giving details of accidents—minor fires and the like—allegedly caused by these devices. Following this, British Standard Specification 2612 has been declared by the Minister of Industries and Commerce to be a New Zealand standard, pursuant to the provisions of the Standards Act, 1941.

We have been told that many dealers throughout the country have taken this to mean that this constitutes a regulation, by virtue of which electric blankets MUST comply with the standard if they are to be sold legally. In actual fact, this is not so. The standard specification is not mandatory, although it can be made so, and as yet there is no indication that it will be made compulsory. Even if it were, enforcement would be delayed for a reasonable time to enable makers' production to be adjusted to it and for local stocks to be absorbed.

It should be realized, too, that non-conformity with the B.S.S. 2612 does not necessarily indicate that a blanket constitutes a hazard. Such specifications include numerous details, many of which are of only minor importance. It is thus possible for an article to equal, or even exceed, a standard specification in all the most important respects, and yet not comply on some point or points of minor importance. At the same time, it is not unknown for argument to exist between expert engineers in a particular field on the framing of the standard specification. Differences of opinion among experts is by no means uncommon, and can lead to the situation that a manufacturer who believes that the specification has not been framed in the best possible way makes his product to a different specification which he considers better, and thus makes no attempt to comply with those portions of the standard with which he disagrees.

The point that we are attempting to make is that *non-compliance with any particular standard by no means implies an inferior product.*

On the other side of the ledger, one should be able to take for granted that any product that does comply with a reasonably drawn standard is, in fact, a good article. This is the real value of such standards, and of such things as the British "kite mark"; nor should their value be under-rated. However, radio and electrical dealers should remember that if they have gained the impression that it is illegal to sell their stocks of electric blankets because they have not been tested for compliance with the standard specification, such an impression is quite erroneous. It is hoped that the above remarks may help to put the matter in correct perspective.

Another point which should not be lost sight of is that, from time to time, British standard specifications—and New Zealand ones, too—are altered. This means that, at a certain time, articles which complied with the old standard probably do not comply with the amended one. Once again we see that non-compliance does not mean that the article in question is in any way inferior or that public confidence in it would be misplaced.

SAFETY OF ELECTRIC HAND-TOOLS

It is not generally realized that small electrically-operated hand-tools, such as drills, polishers, hedge-clippers, etc., form a very real hazard if they are not used and looked after properly. The danger is that the frame of the tool, which is almost always metallic, should at some time not be connected to earth. If this happens, and a failure of the internal insulation should occur, the said frame becomes live, and constitutes a very real danger to the user. For instance, the earth wire which is supposed to connect the frame to the earth system of the supply may be broken. Even if it is intact, the tool may be plugged into a defective socket, so that no earth connection is made, and in either case the result is the same.

Perhaps the best insurance against danger when the frame of a portable appliance is un-earthed is the use of a mains isolation transformer. Without a transformer, it is impossible to earth one side of the supply, because this would earth the neutral wire of the mains, and this is not allowable, but when an isolation transformer is used, one side of the secondary can be earthed as well as the frame of the appliance. There then exists double protection for the user, for both connections to earth would have to break before there was any danger to the user when an electrical fault occurred. Several makes of isolation transformers are available on the market, and, while these are not cheap, their use is very much to be recommended. We feel that electrical dealers who sell portable electric tools should also have isolation transformers available, and should point out their advantages to their customers. Not only is the dealer then doing a public service, but in some cases at least virtue will be rewarded by the sale of a transformer as well as the appliance!

BELLING and LEE LTD

ENGLAND

Components, Aerials and Filters for the Electronic and Electrical Trade

- TERMINALS
- FLEXIBLE TERMINAL BLOCKS
- COAXIAL PLUGS and SOCKETS
- MINIATURE THERMAL PROTECTION DEVICES
- FUSES and FUSEHOLDERS
- INTERFERENCE FILTERS
- HOUSEHOLD-TYPE AERIALS

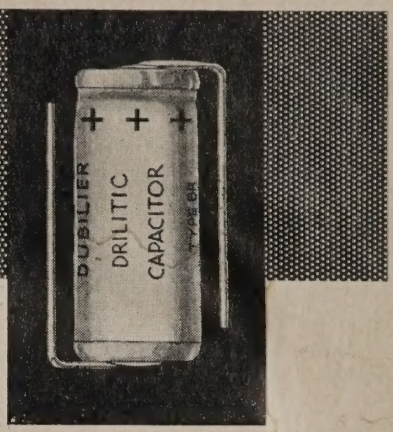
The Sign of Dependable Components

FULL STOCKS AVAILABLE FROM SOLE NEW ZEALAND AGENTS:

TURNBULL and JONES LTD

AUCKLAND : HAMILTON : PALMERSTON NORTH : WELLINGTON : NELSON
CHRISTCHURCH : DUNEDIN : INVERCARGILL

drilitic



ELECTROLYTIC CAPACITOR

type BR

Dubilier "Drilitic" Capacitors need no introduction. Used by manufacturers and service engineers for many years, their reputation for reliability is unparallelled.

Cat. No.	Capacitance uF.	Max. D.C. Wkg. volts	Size (in.) D	Size (in.) L
BR. 1006	100	6	$\frac{5}{8}$	$1\frac{1}{2}$
BR. 501	50	12	$\frac{5}{8}$	$1\frac{1}{2}$
BR. 1001	100	12	$\frac{5}{8}$	$1\frac{1}{2}$
BR. 102A	10	25	$\frac{5}{8}$	$1\frac{1}{2}$
BR. 252A	25	25	$\frac{5}{8}$	$1\frac{1}{2}$
BR. 502A	50	25	$\frac{5}{8}$	$1\frac{1}{2}$
BR. 1002A	100	25	$\frac{5}{8}$	$1\frac{1}{2}$
BR. 25252A	25–25	25–25	1	2
BR. 105	10	50	$\frac{5}{8}$	$1\frac{1}{2}$
BR. 255	25	50	$\frac{5}{8}$	$1\frac{1}{2}$
BR. 505	50	50	$\frac{5}{8}$	$1\frac{1}{2}$
BR. 25255	25–25	50–50	1	2
BR. 50505	50–50	50–50	1	2
BR. 415	4	150	$\frac{5}{8}$	$1\frac{1}{2}$
BR. 815	8	150	$\frac{5}{8}$	$1\frac{1}{2}$
BR. 1615	16	150	$\frac{5}{8}$	$1\frac{1}{2}$
BR. 3015	30	150	$\frac{5}{8}$	$1\frac{1}{2}$
BR. 5015	50	150	$\frac{3}{4}$	2
BR. 8015	80	150	$\frac{3}{4}$	$2\frac{1}{2}$
BR. 202015	20–20	150–150	1	2
BR. 404015	40–40	150–150	1	2

Cat. No.	Capacitance uF.	Max. D.C. Wkg. volts	Size (in.) D	Size (in.) L
BR. 435	4	350	$\frac{5}{8}$	$1\frac{1}{2}$
BR. 835	8	350	$\frac{5}{8}$	$1\frac{1}{2}$
BR. 1635	16	350	$\frac{3}{4}$	$1\frac{1}{2}$
BR. 3235	32	350	$\frac{7}{8}$	2
BR. 16835	16–8	350–350	1	2
BR. 163235	16–32	350–350	1	2
BR. 202035	20–20	350–350	1	2
BR. 323235	32–32	350–350	1	3
BR. 150	1	500	$\frac{5}{8}$	$1\frac{1}{2}$
BR. 250	2	500	$\frac{5}{8}$	$1\frac{1}{2}$
BR. 450	4	500	$\frac{5}{8}$	$1\frac{1}{2}$
BR. 850	8	500	$\frac{5}{8}$	$1\frac{1}{2}$
BR. 1650	16	500	$\frac{3}{4}$	2
BR. 2050	20	500	$\frac{7}{8}$	2
BR. 3250	32	500	$\frac{7}{8}$	$2\frac{1}{2}$
BR. 8850	8–8	500–500	1	2
BR. 101050	10–10	500–500	1	2
BR. 16850	16–8	500–500	1	2
BR. 161650	16–16	500–500	1	2

good sets are better for

DUBILIER

CAPACITORS

★ *Send for Catalogue EC453 for full details of these and many other types to Sole New Zealand Agents:*

E. C. GOUGH LTD.

P.O. BOX 873 PHONE 62-254 CHRISTCHURCH

P.O. BOX 682 PHONE 40-598 AUCKLAND

A brand-new and better-than-ever range for 1957

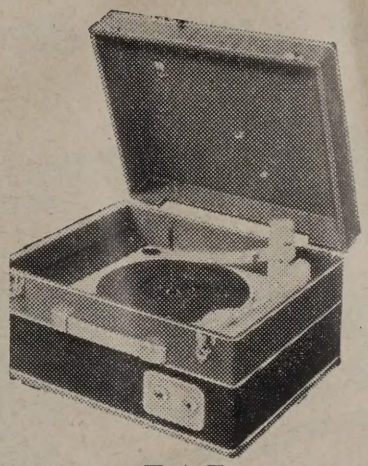
EAR
ELECTRIC AUDIO REPRODUCERS

E.A.R.

Bantam Non-Auto

The New E.A.R. Bantam Non-Auto model, despite its exceptional compactness, is a high performance instrument and incorporates a high flux elliptical speaker and the latest Collaro Motor Unit with automatic stop. Studio pick-up.

£21 10s.

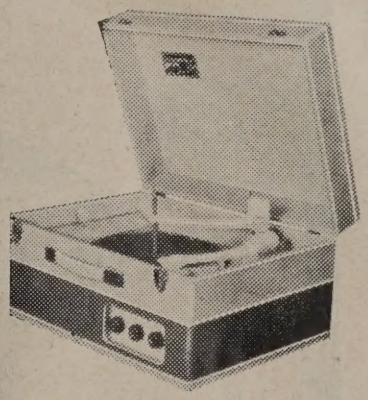


E.A.R.

Bantam Auto

A new version of the popular E.A.R. Bantam Auto in the latest E.A.R. designed cabinet, combining exceptionally attractive appearance with a high degree of portability. TWO MATCHED SPEAKERS for bass and treble.

£28 10s.



E.A.R.

"1960" Portable

TWIN CONCEALED ELLIPTICAL SPEAKERS. Independent Bass and Treble Boost. Outstanding case design. Collaro 10 Record Mixer Changer and Studio P. Pick-up.

£34 10s.

ALSO AVAILABLE: E.A.R. Armchair Consolette. Mounted on a special stand for convenient operation and listening from armchair level. Dual bass (10 x 6) and treble speakers, independent bass and treble boost controls, fully automatic mixer changer and many other outstanding features.

£39 10s.

Balanced High Fidelity

by EAR

OF ENGLAND

New Zealand Distributors:

RUSSELL IMPORT CO. LTD.

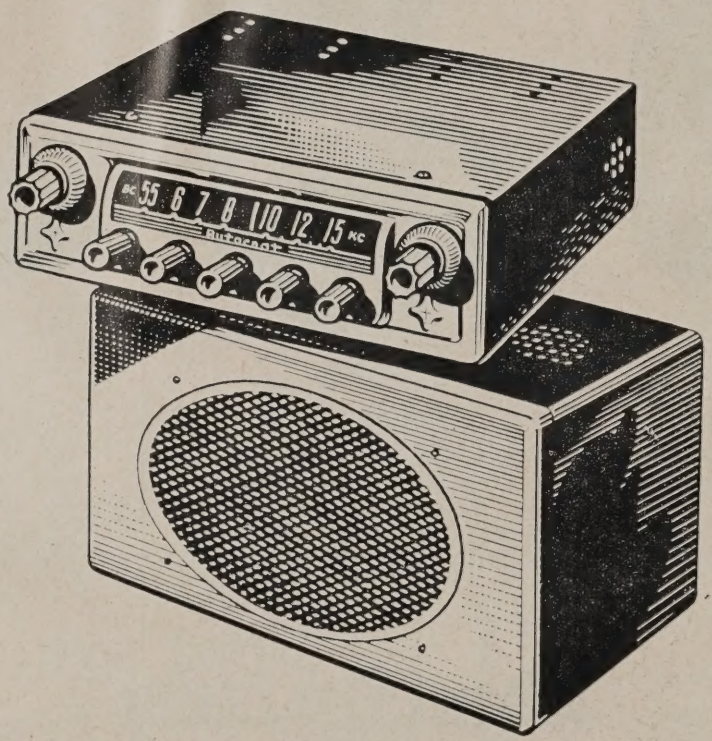
P.O. BOX 9038, AUCKLAND
P.O. BOX 102, WELLINGTON
P.O. BOX 1871, CHRISTCHURCH

ALL E.A.R. RECORD CHANGER MODELS ARE FITTED FOR MANUAL OPERATION FOR L/P RECORDS

there's an

Autocrat

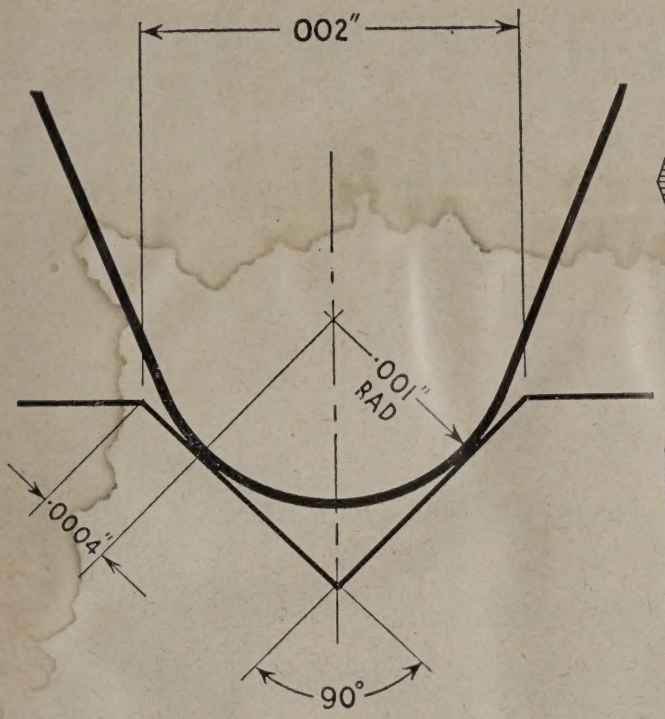
designed and priced for your car



New Zealand's Finest Car Radio!

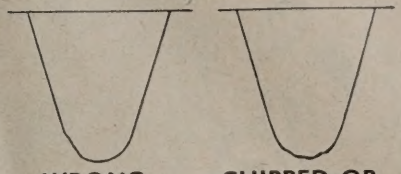
DISTRIBUTED BY AUTOCRAT DISTRIBUTORS LTD., P.O. BOX 2364, AUCKLAND
MANUFACTURED BY AUTOCRAT RADIO LTD.
Branches: P.O. Box 1409, Wellington, and 38 Oxford Terrace, Christchurch

A10



WHAT AN LP STYLUS OUGHT TO BE — THEORETICAL PERFECTION

WHAT IT OFTEN IS —



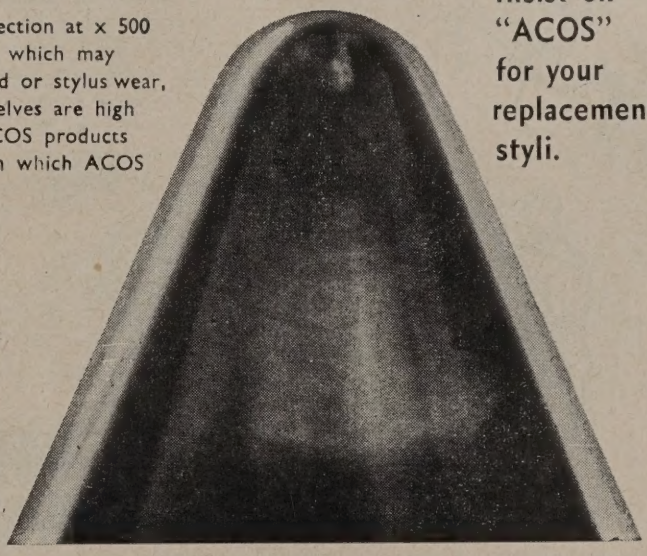
WRONG SHAPE

CHIPPED OR ROUGH SURFACE

acos X500 *

REPLACEABLE STYLI, AS FITTED TO ALL ACOS CRYSTAL AND CERAMIC PICK-UP CARTRIDGES HAVE PERFECT SHAPE, SIZE AND FINISH

* ACOS Styli have to pass a quality inspection at x 500 magnification. Only in this way can some faults, which may have important effects on reproduction or record or stylus wear, be reliably detected. The standards we set ourselves are high but practical. They are reflected not only in ACOS products but also in the record reproducing equipment in which ACOS pick-ups or cartridges are fitted.



Insist on "ACOS" for your replacement styli.

always well ahead

COSMOCORD LIMITED. Eleanor Cross Road, Waltham Cross, Herts. Waltham Cross 5206.

SOLE NEW ZEALAND REPRESENTATIVE

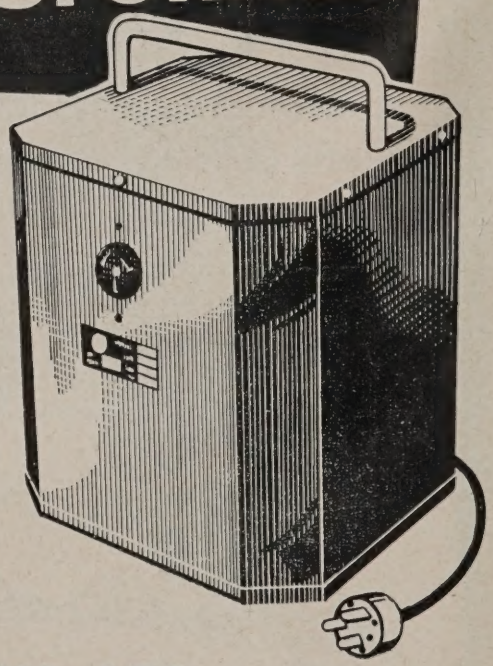
DAVID J. REID, 271 VICTORIA STREET WEST P.O. BOX 2930, AUCKLAND

for perfect safety!

ALL OUTDOOR ELECTRICAL EQUIPMENT

should have a...

BEACON *ISOLATING* TRANSFORMER



Make all electrical appliances SAFE — guard against fatal electrocution . . . with a Beacon Isolating Transformer. It renders all appliances harmless even if the frame should come alive. Sizes range from 250VA up to 3 KVA continuous ratings. Available in steel case, with carrying handle or with wall or floor mounting. Compound filled to prevent moisture absorption.

THIS ISOLATING TRANSFORMER COMPLIES WITH ALL STATE HYDRO REGULATIONS

BEACON RADIO LTD.

CORNER BROWN AND FITZROY STREETS, PONSONBY, AUCKLAND.
P.O. BOX 2757. —— PHONES: 14-704, 13-390.

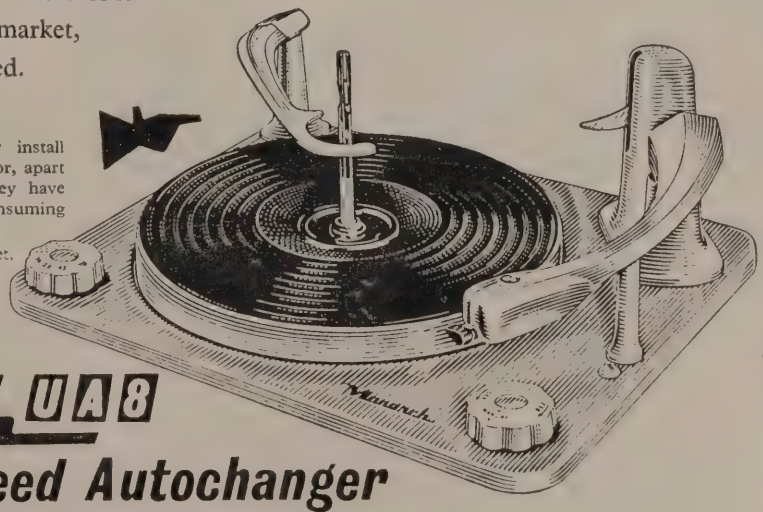
Manufacturers of All Kinds of Transformers and Fluorescent Lamp Ballasts

...now Monarch completes the American day!

In many thousand homes throughout the American Continent, the Monarch U.A.8 four-speed automatic record changer is already a firm family favourite. Nightly it demonstrates its versatility and flawless fidelity—faultlessly. And it will go on doing so for many, many years to come!

The Monarch's superb performance and reliability have earned it top honours with leading American set makers. And in this traditionally hard market, honours are truly earned.

★ Many manufacturers now install the Monarch exclusively, for, apart from its fine performance, they have found it free from profit-consuming after-sales problems.
Please write for U.A.8 data sheet.



Monarch UA8
Four Speed Autochanger

BSR

SOLE NEW ZEALAND DISTRIBUTORS:

David J. Reid (N.Z.) Ltd.

P.O. BOX 2630 :: AUCKLAND

BEST FOR TESTS

model 7 universal

AVOMETER

AVO REGD. TRADE MARK

MULTI-RANGE A.C.-D.C. MEASURING INSTRUMENT

Size: 8 in. x 7¼ in. x 4½ in. Weight: 6¾ lb., including leads. Leather Case available.

The wide range and type of measurement covered, and the small power consumption make this Meter particularly suitable for radio testing, but it can also be used for general engineering. In this connection, reference to the list of Accessories for extension of the Meter range is recommended.

Fifty Ranges: 5 in. hand calibrated scale indicator. Dual A.C.-D.C. switches and press-button range for each value of current and voltage.

Total Meter resistance, 500,000 ohms,

Instrument type rectifier and internal transformer for A.C. measurements.

Three self-contained ohms ranges from 0.5 ohm to 1 megohm; higher ranges with help of Mains, with adjustment for voltage.

Automatic overload cut-out; electrically interlocked switching.

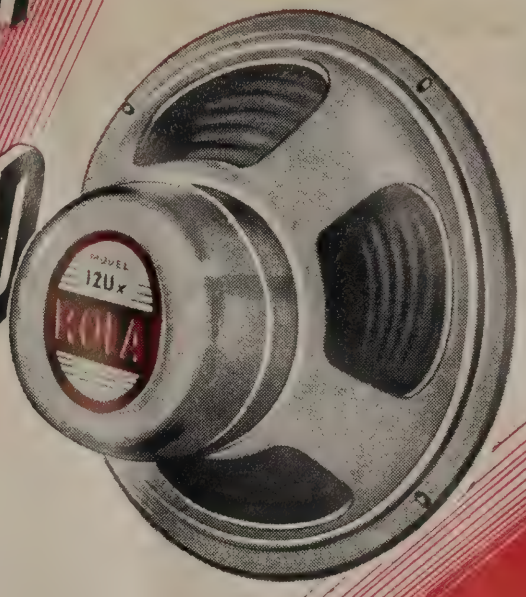
Power, Power Factor, and reactive k.V.A. can be measured on Avo-Meter with AVO Power Factor and Wattage Unit.

DETAILED SPECIFICATIONS ON REQUEST FROM THE NEW ZEALAND DISTRIBUTORS:

THE NATIONAL ELECTRICAL & ENGINEERING COMPANY LIMITED

AUCKLAND — WELLINGTON — CHRISTCHURCH — DUNEDIN — HAMILTON
WANGANUI — NEW PLYMOUTH — HASTINGS — INVERCARGILL

SPOTLIGHT on SOUND



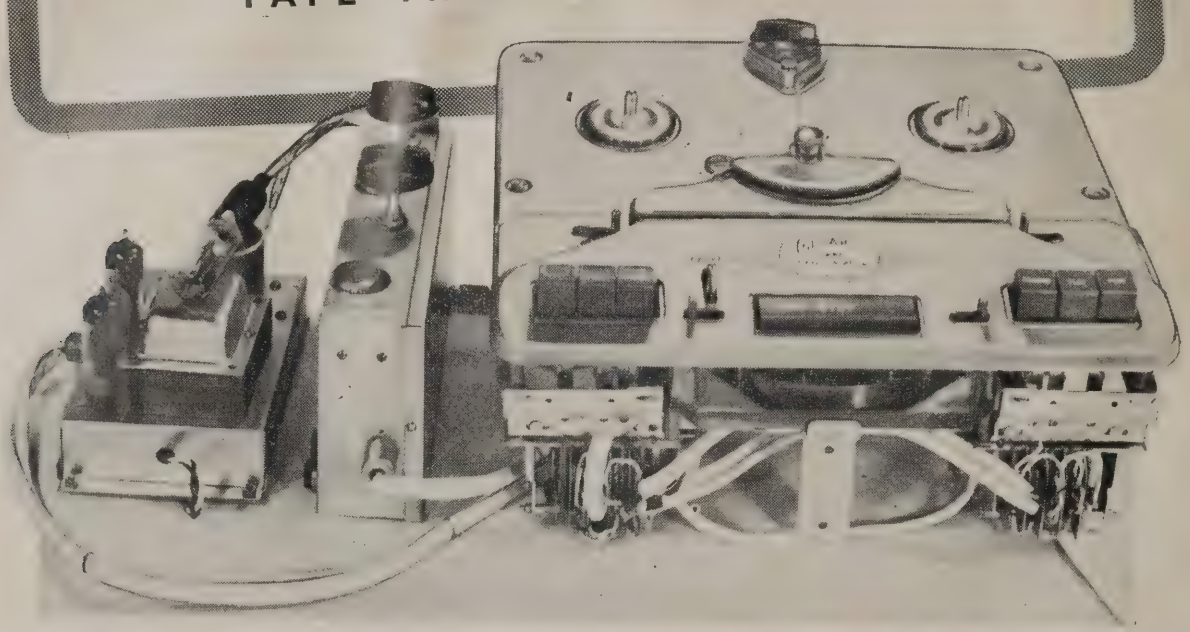
Specifications

Power Handling Capacity	12 watts (Peak)
Fundamental Diaphragm Resonance	50 c.p.s. ± 5 c.p.s.
Frequency Response	45-12,000 c.p.s.
Voice Coil Impedance at 400 c.p.s.	8.4 ohms.
Air Gap Flux Density	13,000 Gausses
Total Flux	278,000 Lines

Arriving soon and worth waiting for!

NEW COLLARO HIGH FIDELITY MARK 'III'

TAPE TRANSCRIPTOR DECK



THE MARK III HIGH FIDELITY TAPE TRANSCRIPTOR DECK

The latest development in famous Collaro tape transcriptors running at speeds of 3¾, 7½, and 15 inches per second—four heads—twin track operation. Incorporating new PAUSE BUTTON allowing instantaneous stop and start without recourse to the main stop button.

Retail £29 15s.

AVAILABLE COMPLETE with PRE-AMPLIFIER AND POWER-PACK UNIT

- All three units are pre-wired via multi-plugs for immediate operation.
- Recording level indicator provided with amplifier.
- Special Collaro hand microphone designed for use with this deck is available and recommended as a separate accessory.

Retail £60

"THE WORLD TURNS TO COLLARO"

NEW ZEALAND DISTRIBUTORS:

RUSSELL IMPORT CO. LTD.

AUCKLAND: St. Mark's Road, Newmarket, P.O. Box 9038, Phone 24-078.

WELLINGTON: 20 Bond Street, P.O. Box 102, Phone 43-436.

CHRISTCHURCH: Y.M.C.A. Bdg., cnr. Cambridge Ter. and Hereford St. P.O. Box 1871, Phone 62-705.

AVAILABLE NOW FOR N.Z. CUSTOMERS . . .

RCA

New Orthophonic High Fidelity

Reviewing this impressive new Amplifier in the May 1956 "Gramophone," P. Wilson describes it as "clear," "refreshing," and "dynamic." "There is never a moments uneasiness but always the feeling that if need were shown, as it might be if one were demonstrating in a large room, one could turn up the gain ad lib. Exactly the feeling, of course, that one gets in driving a high-powered car." New Zealand connoisseurs who have heard the amplifier in action wholeheartedly agree with Mr Wilson. Designed for successful incorporation in any home audio system, the new R.C.A. Amplifier, both because of its outstandingly realistic reproduction and its handsome appearance, is certain to be enthusiastically received by everyone interested in high-quality audio equipment.

Output: 12 watts rated. Peaks in excess of 20 watts over 20–20,000 c.p.s

Distortion: Total harmonic less than .1% at 10 watts–700 cycles.

Frequency Response: Within 0.2DB 20–25,000 c/s ± 0.5DD 10–60,000 cqs.

Feedback: 40 DB total.

NEW ZEALAND DISTRIBUTORS:

AMALGAMATED WIRELESS (AUSTRALASIA) LIMITED

P.O. BOX 830, WELLINGTON. P.O. BOX 1363, AUCKLAND. P.O. BOX 2084, CHRISTCHURCH.

Key 100

FREE
NEWSPAPER BLOCKS
available in sizes to suit your advertising requirements

FREE
RADIO COPY
featuring your name and address

FREE
SCREEN SLIDES
for all models—supplied complete with your firm's name and address

FREE
SHOWCARDS
to help you with your own point-of-sale displays

FREE
PRICE TICKETS
issued with each model as it is released

ADDITIONAL BULLS
of all advertisements, supplied in quantity. Suitable for your local mailings or for shop distribution

HOW BELL HELPS YOU SELL MORE RADIOS

WITH NATION-WIDE ADVERTISING

Through metropolitan and provincial newspapers, through the national network of commercial radio, BELL reaches customers in every corner of New Zealand. Four days every week, over 200,000 homes hear BELL announcements. Every month, BELL newspaper advertisements are looked at nearly 1½ million times. The name BELL is no stranger to the customer when he enters your door.

WITH EXTRA SERVICES TO YOU

Bell's 'Dealer Service' Plan helps you sell more radios and saves you **real** money at the same time. Shown at left are some of the ways you benefit.

WRITE NOW FOR FREE MATERIAL

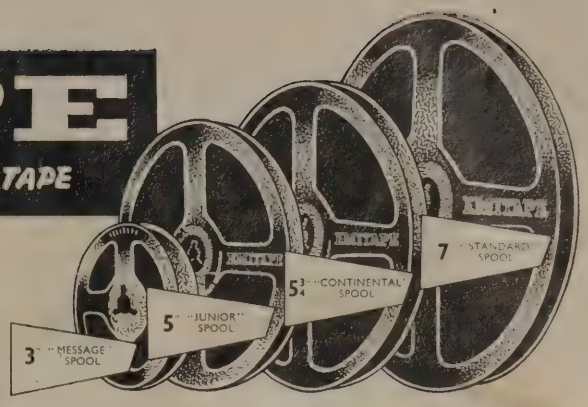
BELL Radio

BELL RADIO-TELEVISION CORP. LTD.,
274 Dominion Road, Auckland

Sell MORE radios, make MORE satisfied customers—write NOW for your requirements DIRECT to BELL DEALER SERVICE, CASSRELS ADVERTISING LTD., P.O. BOX 2491, AUCKLAND.

EMITAPE

THE WORLD'S FINEST MAGNETIC RECORDING TAPE



With the arrival of fresh stocks from overseas, Emitape now comes to you in a complete new price range, with certain lines greatly reduced.

Emitape is available in a range of four spool sizes, and is suitable for all tape recorders.

LOOK AT THESE QUALITIES THAT HAVE MADE IT WORLD FAMOUS . . .

- High Sensitivity
- Anti-Static
- Freedom from curl
- Low "Print Through" Factor
- Pre-Stretched P.V.C. Base.

- Metallic Contact Strips for "Auto-Stop" fitted all but the "Message" spool, together with P.V.C. Leader and Trailer Strips.

EMITAPE COMES IN THREE DIFFERENT TYPES . . .

Emitape "77"—A "Special Application" tape, "pen-tested" for professional use.

Emitape "88"—A Standard thickness base tape giving maximum durability for GENERAL PURPOSE use.

Emitape "99"—A specially developed thin-based tape giving an increase of 50% recording time for LONG-PLAYING purposes.

All three types of Emitape have identical magnetic oxide coating and electrical characteristics.

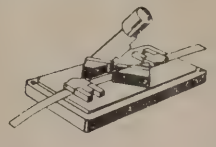
DISPLAY THIS NEW PRICE LIST ON YOUR COUNTER

"Message"	3 in. spool	88/3	175 ft.	9/–
		99/3	250 ft.	11/6
"Junior"	5 in. spool	88/6	600 ft.	28/6
		77/6	600 ft.	28/6
		99/9	850 ft.	34/6
"Continental"				
	5¾ in. spool	88/9	850 ft.	34/6
		99/12	1200 ft.	43/6
"Standard"	7 in. spool	88/12	1200 ft.	46/–
		99/18	1800 ft.	60/–
		77/12	1200 ft.	57/6

EMITAPE ACCESSORIES

JOINTING BLOCK and CUTTER AP 46.

This new design of Jointing Block enables a noiseless joint to be made when splicing and editing a recorded magnetic tape. .. 19s. 6d.



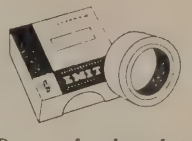
EMPTY PLASTIC SPOOLS IN CARTONS

Full range of Empty Plastic Spools availaable in Cartons for programme storage of recorded tapes, or for special mailing purposes.

AP 93 3 in. Dia. "Message" 4/..
AP 85 5 in. Dia. "Junior" 7/3
AP 89 5¾ in. Dia. "Continental" 7/6
AP 87 7 in. Dia. "Standard" 8/9

JOINTING COMPOUND AP 36 for C.A. BASE TAPE and 78E for P.V.C. BASE TAPE.

A specially prepared Jointing Fluid which enables a permanent welded joint to be made, when splicing or editing either P.V.C. or Cellulose Acetate base Magnetic Recording Tape. .. .. 11s. 6d.

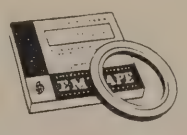


P.V.C. EDITING AND MARKER TAPES AP 38/1 to 38/6.

Range of coloured tapes to enable colour code references to be inserted in a reel of recorded tape for quick editing and indexing purposes. Colours available: AP 38/1 White; /2 Red; /3 Yellow; /4 Blue; /5 Orange; /6 Green. 6s. 8d.

NON-MAGNETIC SCISSORS AP 39.

Manufactured from a non-ferrous material, these scissors enable a recorded tape to be cut for splicing and editing purposes without magnetizing the tape. In this way a noiseless joint is assured. 16s. 8d.



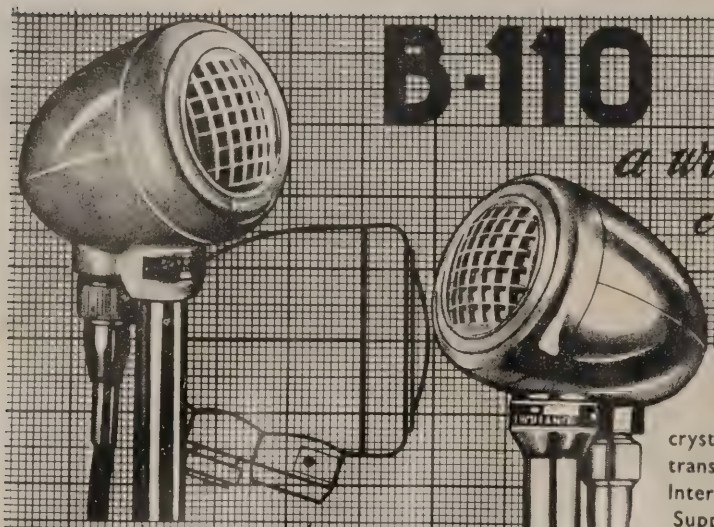
JOINTING TAPE AP 103.

Specially prepared Adhesive Jointing Tape for simple and quick splicing and editing of Magnetic Recording Tape. .. .. 11s. 6d.

AVAILABLE IN NEW ZEALAND ONLY FROM:

HIS MASTER'S VOICE (N.Z.) LTD.

BOX 296 ——— WELLINGTON



B-110

a world-famous crystal microphone by **Ronette**

Effective output: 1.1 mV/μBar at 1000 c/s
Load resistance: 5 MΩ
Frequency range: 30-13000 c/s
Outp. impedance: equal to 2200 μμF

RONETTE'S B-110

crystal microphone is very popular among transmitting amateurs all over the world. Internally screened against stray h.f. fields. Supplied with standard cable connector.

Can be mounted on all 5/8"-27 threaded microphone stands

GREEN & COOPER LTD.
43 LOWER TARANAKI STREET, WELLINGTON
Phone 54-418. Telegrams: "Fidelatone"

FAMOUS MICROPHONES

Poly-Q

B-A-N-D
S-P-R-E-A-D

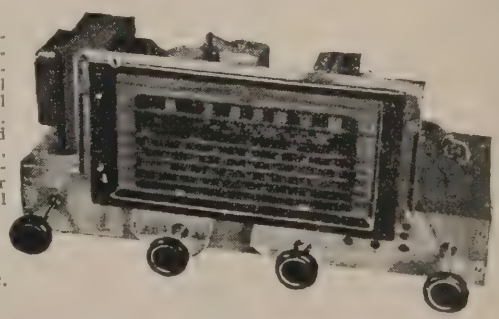
BASIC KIT—TYPE 9

Completely assembled, wired, and tested up to converter tube.
Fitted to sturdy 8/9 valve, plated steel chassis.
Accurately aligned to dial calibration.
You merely add I.F. and audio stages.
The spread on shortwave makes shortwave tuning easier than broadcast.

IDEAL as base for really high-quality RADIOS, TUNERS, RADIOGRAMS, etc.

Details:

49, 31, 25, and 19-metre bands, plus broadcast. Extremely accurate calibration and frequency stability. Split stator tuning condenser and temperature compensated oscillator. Only three simple adjustments necessary to completely align each bandspread band Handsome floodlit dial scale. Effortless tuning from high ratio 24/1, ball-bearing spin wheel drive. Gang isolated from mechanical and electrical vibration and noise. Bandspread calibration linear and marked in 100 k/c divisions and fractions thereof. A 0–100 logging scale also provided. "BAND", "TONE" and "GRAM." indicators fitted. Special A.V.C. system provides shorter time constant on shortwave to rapidly compensate for fading signal. Polystyrene low-loss adjustable slug coils throughout. Full instructions and suggested I.F. and audio circuits.



Price:

£16/19/7 (retail), less valves, plus packing, and postage.
(Valves, £1/5/6; packing, 6/6; postage, 6/6, approx.)

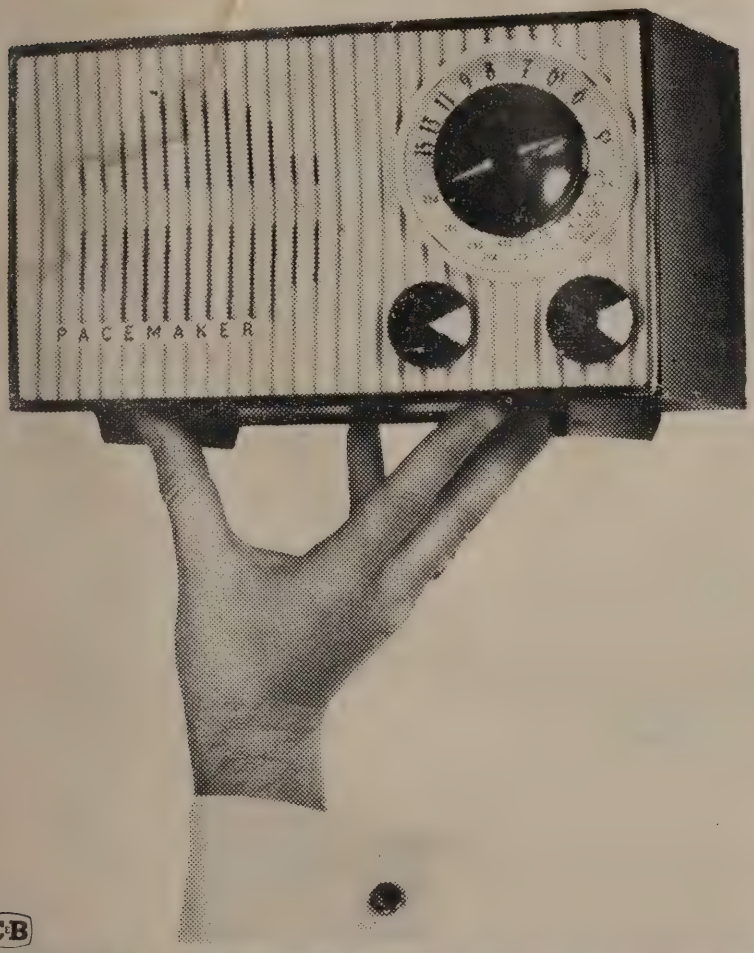
See them at our Stockists, or write direct for full particulars.

INDUCTANCE SPECIALISTS LTD.
157 THORNDON QUAY :: :: WELLINGTON

NOTE:—Special assembly available covering amateur bands. Full particulars on request.

the little set with the

BIG PROFIT



C·B

PACEMAKER

because of the quality behind the dial

Manufactured for the distributors, H. W. Clarke (N.Z.) Ltd.; *by* Collier & Beale Ltd.

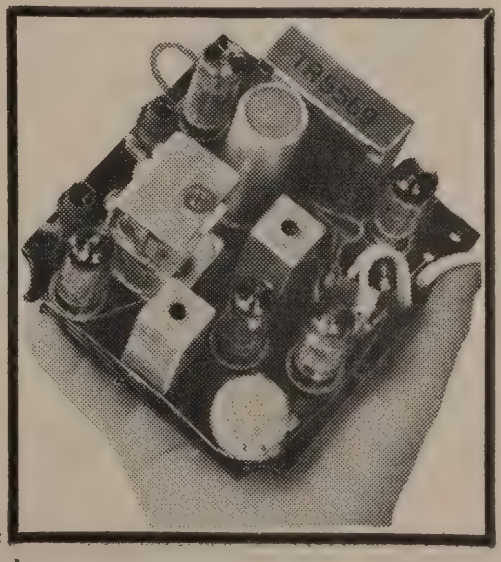
G.9142

Get right behind the Pacemaker Petite, and make big profits fast!

So small in size—so *big* in performance! The Pacemaker Petite . . . ideal 'second-set' for the modern home. A powerful little 5-valve mantel radio with outstanding qualities in reception and reproduction. Unique plastic cabinet carries easy-to-read clock dial with Station identification, full variable tone control and A.C. switch. Entire set weighs only five pounds . . . measures only 6 inches in height, 5¼ inches in depth! Available in six attractive cabinet colours . . . Ivory, Walnut, Maroon, Pastel Green, Pastel Blue and Red.

Retail price only £15/15/-.

The Pacemaker Petite's compact, held-in-hand, plastic chassis with latest type miniature tubes, latest 5-inch PM. speaker, and modern 'bare-wire' circuit. Superbly engineered for a long life of trouble-free performance.

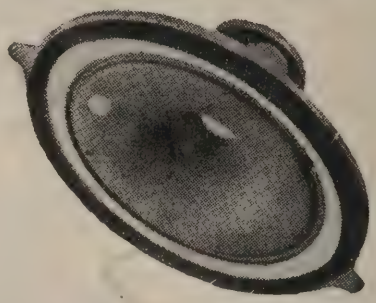


BAKERS HIGH-FIDELITY SPEAKERS

ARE RAPIDLY GAINING IN POPULARITY

BECAUSE OF THEIR SMOOTH

WIDE-RANGE RESPONSE



9 in JUNIOR DE LUXE, Mk. II; 8 w. 15 ohms 40-20,000 cycles

£11 10s.

12 in. ULTRA 12 FLUID SUSPENSION, 20 w. 15 ohms 20-25,000 cycles—

£23 12s. 6d.

12 in. DE LUXE, 15 w. 15 ohms 20-17,000 cycles—

Mk. I, **£14 10s.** Mk. II, **£16 2s. 6d.**

ULTRASONIC TWEETER, 12 w. 15 ohms, 1,000 to 25,000 cycles—

£11 18s. 6d.

LAMPHOUSE AUDIO DIVISION

People's Palace Building, 213 Cuba Street, Wellington

ACCURATE ▪ STABLE ▪ RELIABLE ▪ PORTABLE ▪ EASY TO SET UP ▪ EASY TO READ

RCA VOLTOHMYSTS

superior quality test instruments

RCA-WV-77-B . . . ALL-NEW JUNIOR VOLTOHMYST—one of the greatest values in vacuum-tube volt-ohmmeters. Embodies several new design features in addition to operational characteristics which have made earlier versions of the instrument the choice of thousands in radio and TV servicing, industry, electronics, communications, broadcasting, and in the armed forces. Complete with WG-299A DC/AC-Ohms probe and cable, instruction booklet.

RCA-WV-87A . . . MASTER VOLTOHMYST—features a 27 sq. in. meter. Its easy-to-read peak-to-peak scales are particularly useful for TV, radar, and other types of pulse work. Has accuracy and stability necessary for many laboratory applications. Complete with probes and cables, including: WG-218 direct probe and cable, WG-222 DC/Direct probe, ohms probe and cable, current leads, negative current lead, ground lead and instruction booklet.

RCA-WV-98A . . . ALL-NEW SENIOR VOLTOHMYST—incorporates all the important time-proved performance features of earlier VoltOhmysts including direct peak-to-peak readings of complex waveforms. The new Senior VoltOhmyst includes an improved ircuit providing greater accuracy, and a BIG full-vision meter face with the easiest-to-read scales ever designed into a VTVM! Complete with WG-299A DC/AC-Ohms probe and cable, instruction booklet.

SOLE NEW ZEALAND DISTRIBUTORS:

Amalgamated Wireless (Australasia) Limited

P.O. BOX 830, WELLINGTON — P.O. BOX 1363, AUCKLAND
P.O. BOX 2084, CHRISTCHURCH

We proudly announce our appointment as
Sole New Zealand Representatives for

LUSTRAPHONE LTD.

OF ENGLAND

Microphones of all kinds and for every application.

IN STOCK: HIGH AND LOW IMPEDANCE
CRYSTAL AND RIBBON VELOCITY
FULL VISION TYPES
NOISE CANCELLING TYPES, Etc., Etc.

Also available the NEW PORTABLE Transistor 10-watt Public Address System.
For the best value in MICROPHON buy LUSTRAPHONE.

POCKET pH METER Type pH 54

For fast, accurate measurements in the plant and in the field, independent from power lines.

Measuring range: 2 to 12 or 0 to 14 pH.

Accuracy: Better than ± 0.1 pH.

Built-in Temperature Regulator.

Lifetime of Batteries: Normally one year.

Complete with leather case, electrode, and thermometer—special electrodes available for all applications.

Ask for detailed leaflet.
Send also for details of:

Conductivity Meters
Multi-Megohmeters
Moisture Meters for all substances
Precision Measuring Bridges
Shielded Transformers
Meters to measure:
Dipole Constant Dielectric Loss
Electric Dipole Moment of Molecules

Made by
Wissen-
schaftlich-
Technische
Werkstatten
Weilheim/
Obb.

IN THE FIELD OF ELECTRONIC DEVELOPMENT · LEADERS · ERL

Electronic Research Ltd.

DEVON STREET,
NEW PLYMOUTH, N.Z.
P.O. BOX 375.

Transistors

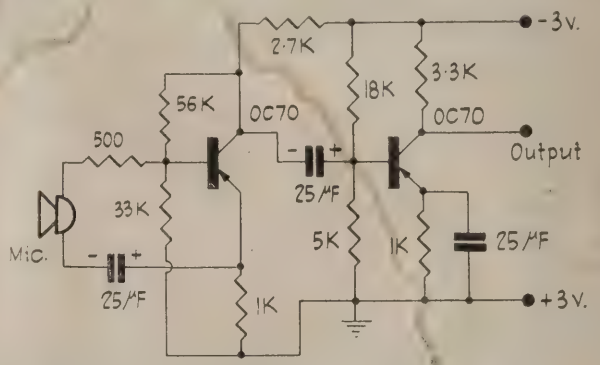
A HOME-BUILT TRANSISTORIZED MICROPHONE

We have often been asked to feature articles describing transistors' use in circuits that will be useful to amateurs and home-constructors. Since transistors can now be bought at prices that many of us can afford to pay, we have pleasure in starting the ball rolling with a circuit which will be found extremely useful for a variety of purposes.

Introduction

In the course of conversation with readers and others, we are very frequently asked our opinion on the possible speed with which transistors will or will not replace conventional valves in domestic equipment. We are also asked why we have published relatively few circuits that use transistors. The answer to the first question is that transistors are not likely to replace valves for a very long time, if ever. There will always be applications for which conventional valves are more suitable than transistors, and it may well be that domestic radio receivers and audio amplifiers both fall into this class. By this, we do not mean to say that transistors will not enter the field of domestic radio at all seriously, for it should be obvious by now that portable radio sets, to name only one example, are ideally suited to transistors, and transistors to them.

It seems likely, too, that, before long, transistors will make a real impact on the design of car radios, and, indeed, of all compact, portable equipment that now uses valves. Thus, the total impact of transistors on home equipment will, in the long run, probably be very great. However, until transistors become much cheaper than they are at present, it seems very unlikely that the common or garden radio set and the high-quality audio amplifier will be very much affected either in design or performance by the advent of the transistor. The same thing applies with equal force to all valve applications in which miniaturization and low current consumption are not of first importance. Nevertheless, there are still plenty of things that the special properties of the transistor will make not only desirable but practicable as well. As a simple illustration of this, we present an arrangement that should be found very useful by experimenters and amateur transmitters. It is a simple device, consisting of a 2 in. or 3 in. permanent-magnet moving-coil speaker, which is used as a microphone. It is well known that these small speakers make excellent mikes, especially for voice-only applications. They are robust, have a reasonably level frequency response over the range of voice frequencies, and are inexpensive enough to make their use as a microphone attractive. To use them as such, though, requires that a good deal of amplification be built into the equipment with which they are to be used. This is because of their small voice-coil, containing only a few turns, which results in an audio output, when used as a microphone, of only a few millivolts, even for close talking. For intercom. units, where they are used in the dual role of speaker and microphone, use is usually made of a step-up transformer to reduce the necessity for a very high-gain amplifier. For instance, an output transformer, such as is used with the speaker in its normal application, can easily be used also as a step-up transformer, into the grid of the first amplifier tube. In this way it will enable a simple amplifier, such as a 6J7, feeding a 6V6, to be fully loaded by the speaker as a microphone. It is often necessary, though, for a microphone to be used with existing equipment that may not have a pre-amplifier tube built in. In such a case, the speaker's output will certainly not be great enough to drive the amplifier, and even with a step-up transformer its output might still be too small. It then becomes necessary to use a pre-amplifier of some sort. If an extra tube can be built into the equipment, all may be well, but it is often impossible or undesirable to do this, in which case the only answer is to use a microphone with more output. Unfortunately, microphones with large output voltages are few and far between, and, in general, their quality is not good. This is true of the carbon microphone, as used in telephones. Besides, these require a source of operating current and a transformer if they are to be used at all.



Circuit of the transistor amplifier for the small moving-coil speaker that acts as a microphone. The whole amplifier circuit and its three-volt battery are accommodated in a small box that houses the speaker unit.

It is under such circumstances that the moving-coil speaker would come into its own if it were not for its small output voltage, and it is here than transistors come to the rescue. A transistor amplifier can be built into such a small space, even if sub-miniature components are not used in its construction, that it can be housed in a space no bigger than the waste room

available when the speaker is mounted in a small metal box no bigger than is needed to accommodate the unit itself. There is even room inside the box for the small battery that must be used to run the pre-amplifier. In this way, the transistor amplifier takes up only what would be waste space, and so uses no additional room at all. A two-stage amplifier will raise the output to more than one volt, which means that it can be used to excite even the least sensitive of amplifiers.

The Amplifier Circuit

In the diagram is shown the circuit of a suitable two-stage transistor amplifier that has been built in our laboratory in the way described above. It uses two hearing-aid transistors, type OC70, and has an output of more than one volt when used with a 3 in. speaker as the microphone. The whole thing operates from a three-volt battery, made from two pen cells in series, and permanently housed in with the speaker and amplifier in a small rectangular box $3\frac{1}{2}$ in. square and $1\frac{7}{8}$ in. deep. On the side of the box is an on/off switch, not shown in the diagram, connected in the negative battery supply lead to the amplifier. Since there is no warm-up period with transistors, this switch can be used as a press-to-talk switch. It could also be made a double-pole one, with the spare section used to turn on a transmitter, or the H.T. to the main audio amplifier, if desired, so that the whole audio or radio system functions only when the press-to-talk switch is operated.

Both transistors are connected in what is known as the grounded-emitter arrangement. Since the first stage is slightly unusual in one respect, the best one for those unaccustomed to transistor circuits to examine for a start is the output stage. The emitter (the electrode represented by the arrow) is earthed, through a bypassed resistor whose function will be described later. At any rate, it is earthed as far as signal is concerned, just as is the cathode of an ordinary amplifier valve. The positive rail of the three-volt supply is also earthed, so that the "H.T.," if such it can be called, in a transistor circuit has its negative terminal "hot." Output is taken from the collector circuit, which has connected in it a load resistor of 3.3k. It is across this resistor that the output voltage is developed, just as in a valve amplifier. The input signal is applied to the base, which is always represented by the heavy line, the thin one without the arrow being the collector. In this circuit, then, the base corresponds roughly to the grid of a valve, in that the signal is applied to it, and also that it has to be biased in order that the transistor may amplify in a reasonably distortionless manner.

In a transistor, collector current can flow only when emitter current flows, and it is in this way that the emitter controls the output, which consists of current variations in the collector circuit. As with a valve, there must be a certain standing current through the load resistor, in order that the current may not only increase, but also decrease from this standing value, in producing the audio signal. As always, if the signal is a sine-wave, the increases due to one half-cycle must equal the decreases due to the other half-cycle if the output is to be free from distortion. As was mentioned earlier, the output from the pre-amplifier is approximately one volt peak, or two volts peak-to-peak. This means that the standing current in the collector circuit must be at least 0.3 ma., because this would just allow the collector current to swing to zero on one peak of the cycle. The current swing would then be from 0 ma. to 0.6 ma. through 3.3k., and this would result in a two-volt p-p signal across the load resistor.

In actual practice, the collector current is somewhat larger than this minimum requirement, because, as with valves, distortion sets in at currents close to cut-off, and the current in the collector circuit must not be allowed to swing too low. In some ways, transistor circuits are easier to figure out than valve ones. For instance, a glance at the circuit and a small sum in Ohm's Law is enough to give a quite accurate idea of the emitter and collector currents in the transistor circuit.

With junction transistors, like these ones, the emitter current is always very nearly equal to the collector current, and the base current is very much smaller, and is, in fact equal to the difference between the two. For instance, if a transistor has a current gain of 0.95, as it might well have, this means that the collector current will almost always be 0.95 of the emitter current. Thus, if the collector current is 0.95 ma., the emitter current must be 1 ma., and the base current must be 0.05 ma. Now, since the emitter and collector currents are so nearly equal, we can, as an approximation, ignore the base current and say that the two actually are equal. Indeed, if the connection to the base were broken, they would, in fact, be equal, because there would be nowhere else for current to go! Now, we know that the D.C. resistances of a transistor are very small, so that we get a very good idea of the operating current if we assume this to be zero, as well as assuming that the base connection is broken. In this way, the circuit is boiled down to the 3.3k. and 1k. resistors in series, connected across a three-volt supply. The current in this must then be $3/4.3 = 0.7$ ma.

It can be seen from this that, with an output of 2v. p-p, there is no danger of the transistor approaching cut-off at any part of the cycle.

How the Transistor is Biased

In order for the emitter circuit to draw current, bias must be applied between the emitter and the base in such a direction as to cause this current to flow. With the OC70, which is a p-n-p transistor, the emitter can conduct only when it is positive with respect to the base, or, which is the same thing, when the base is made negative with respect to the emitter. Since the collector battery's positive terminal is connected to the emitter, the right polarity is obtained for biasing the emitter if the base is connected to the live terminal of the battery in some way. Thus, no separate bias battery is needed with the grounded-emitter circuit, which is one of its greatest advantages. One way of

biasing the base correctly is merely to connect it to the negative terminal of the battery through a resistor of the right value. Suppose, for example, that we have a transistor with a current gain of 0.95, as in our previous example, and we want to find the right bias resistor for giving a collector current of 1 ma. The base current must be 0.05 ma., and it must flow from the base, through the resistor, to the negative battery terminal. Since the voltage drop in the base-emitter junction is so small as to be ignored for purposes of calculation, we can say that the base current is entirely determined by the battery voltage and the value of the base resistor whose value we want to find. Therefore, a simple application of Ohm's Law to the problem will give the required answer. We have:

$$0.05 \text{ ma.} = 3/R$$

from which R = 60k.

Since the base-emitter resistance is only a few ohms, and since the 1000-ohm resistor in the emitter circuit is very small compared with the required resistance of 60k., there will be negligible error if we use an actual resistor of this value.

The system described is actually the simplest one for biasing a grounded-emitter transistor, but it is not often used, because it has certain disadvantages. The main one is that if the transistor's temperature varies, its characteristics change in such a way that the currents increase, shifting the operating point. The simple biasing circuit described can do nothing to offset this variation, which is likely to cause a considerable change in the gain of the stage.

In this amplifier, we do have a resistor from the negative supply terminal to the base, but there is another between base and earth. The bias is thus obtained from a voltage divider rather than from a series resistor, and this tends to stabilize the base current, irrespective of temperature changes. There is also a resistor in the emitter circuit, bypassed by a 25 $\mu\mu$f. condenser. This also acts to stabilize the operating point of the transistor, this time by introducing negative feedback. If for any reason the emitter and collector currents should increase, a potential is developed across the 1k. resistor in series with the emitter in such a polarity as to make the collector more negative with respect to the earth line. But, since the base of the transistor is held at an almost fixed potential by the voltage divider, this means that the emitter becomes less posiitve than before with respect to the base. This, in turn, tends to decrease the base current, and therefore to decrease the emitter and collector currents also. Thus, the changes in emitter potential brought about by the presence of the emitter bias resistor oppose any change of current that takes place for any reason at all; this behaviour is negative feedback, and will apply equally well to current changes caused by the signal applied to the base, so that, if the emitter resistor is not bypassed, the audio gain is reduced as well as the undesired variations in operating current.

All this is very reminiscent of the behaviour of a valve, with a resistor in the cathode circuit. In the case of the valve, however, we have become so used to the stabilizing effect of cathode bias on the plate current that we tend to forget about it, but it takes place just the same, and largely accounts for the fact that our ordinary valve circuits give so little trouble over long periods, in spite of the fact that valves age and resistors gradually change their values.

Large Coupling Condensers

The output of the first transistor is coupled to the second through a 25 μf. coupling condenser. To those unused to transistor circuits, this capacity seems enormous, so that a little explanation of its necessity would perhaps not be out of place. The shortest and simplest answer is that the input impedance of a transistor is very low compared with that of a valve. With the latter, we are used to seeing grid leak resistors of half a megohm or more, with coupling condensers of about 0.05 μf. As everyone knows, we rely on the time-constant of this combination of C and R being long, in order to secure a flat response down to the lowest frequencies in which we are interested. In fact, the product CR in megohms and microfarads, or in ohms and farads, can be expressed as so many seconds, and for the low-frequency response to be good, this time must be long compared with the time taken by one cycle at the lowest frequency of interest. In a typical case, we might have a 1-Meg. grid leak, and a coupling condenser of 0.1 μf. This combination has a time-constant of $0.1 \times 1.0 = 0.1$ sec. Now, suppose that we want our response to be flat down to 50 c/sec. One cycle at this frequency takes 0.2 sec., and so we have CR equal to five times the duration of one cycle. This will give a response at 50 c/sec. that is immeasurably smaller than the response at higher frequencies, where the capacity coupling causes no loss at all. Thus, whatever the value of the resistor into which the signal is being fed, we can obtain the same response at 50 c/sec. by seeing that CR is always as large as 0.1 sec. Thus, if in our hypothetical valve circuit we substituted a 100k. grid leak for the 1 Meg. one, we would have to increase the coupling capacity to 1 μf. to keep the response the same as before. Now, in a valve circuit, the input impedance at audio frequencies is equal to the value of the grid leak resistor, because the input impedance of the valve itself is so high that, in parallel with the grid leak, it makes no observable difference. In a transistor circuit, however, things are different. Unlike the grid of a valve, the base of a transistor does pass current, and so the input impedance is much lower than the value of any resistor that may be connected between the base and earth. In the case of the second stage in the amplifier circuit, the impedance from the coupling condenser's positive terminal to earth would be equal to 5k. in parallel with 18k., IF THE TRANSITOR WERE UNPLUGGED. But the input impedance of the transistor itself is, in general, much lower than the value of any of the resistors in the circuit—exactly the opposite of the valve. With the OC70, this input impedance is of the order of 500 to 1000 ohms, so that the circuit's input impedance will

be very slightly less than this, owing to the presence of the resistors. For approximate calculation, let us asume that the input impedance is 1000 ohms. If we want response down to 50 c/sec. to be flat, as before, we will need a coupling condenser of 100 μf.

It is easy to see, therefore, that the 25 μf. we have used in the circuit is by no means excessive. Indeed, for response below 50 c/sec., it would hardly be enough, but in this case, we are interested in speech frequencies only, and the response of the output stage will be flat down to about 200 c/sec., and will be only about half a decibel down at 50 c/sec. From this it appears that it would have been possible to use a smaller coupling condenser, but since we wanted to specify only standard parts that are readily obtainable anywhere, 25 μf it is.

The First Amplifier Stage

The circuit of the first amplifier stage is very similar to that of the second, the only differences of any consequence being that the collector load resistor is a bit smaller, and the values in the bias network are somewhat larger. Since the first transistor has to deal with only a very small signal, it is possible, and thus desirable, to run it at a much smaller current without causing signal distortion, and this is what has been done.

There is, however, one point that is worth talking about, as it highlights another property of transistors that it is most important to understand if one is to make the best use of them. It will be seen that the microphone is connected in series with a 500-ohm resistor, and a 25 μf. condenser, between base and emitter of the first transistor. The reason for the condenser should be obvious, because, if it were not there, the microphone would short-circuit the 33k. and 1k. resistors, and the correct emitter bias would no longer be obtained.

Not so obvious, though, is the use of the 500-ohm resistor in series with the microphone. It is there to avoid serious distortion. A transistor, unlike a valve, is a current-operated device. Among other things, this means that the output *current* will be a replica of the input current, and since the output voltage is obtained by passing the output, or collector, current through a resistor, we have the situation that the output voltage is also a replica of the input current, rather than of the input voltage. Now, the microphone has a very low impedance—about 3 ohms—and generates a *voltage* at its terminals which represents the waveform of the speech that hits the diaphragm. Now, the power available from the microphone is very small, so that, if it is directly connected to the transistor input, the current drawn by the base will badly distort the voltage output of the microphone. The transistor input current will therefore be distorted also, and so will be the output. If this distortion is to be avoided, we must do something which ensures that the current input to the transistor is a replica of the voltage output of the mike. The only way to do this is to connect a resistor in series with the microphone, and give it a value that is much higher than the impedance of the microphone itself. By doing this, we set up a circuit in which the current in the input circuit is almost independent of the input impedance of the transistor. With the series resistor present, the transistor input impedance can have any value at all without affecting the current output of the microphone very much, and distortion is therefore avoided.

Gain Control

In the circuit, no variable gain control has been shown, because it has been assumed that the pre-amplifier is to feed a valve circuit in which such a control is present. However, if it is desired to reduce the pre-amplifier's output voltage, the best way to do it is to increase the value of the 500-ohm series resistor. As this is increased, the current in the base circuit of the first stage is decreased, so that the output is reduced. It would be possible to put a variable resistor of, say, 10,000 ohms in series with the 500-ohm resistor, whereupon the variable would make an excellent volume control. In any case, if the full output of the pre-amplifier is not needed, it is a good plan to increase the value of the series resistor until the output is just a little greater than the maximum required, since doing this will reduce distortion still further. However, it will be found that the circuit as drawn will give excellent quality, and is far from a merely experimental one that will make some sort of noise. It is a thoroughly practical device, and should find many uses, either in the ham shack or among the P.A. operator's equipment.

PUBLICATIONS RECEIVED

From A.W.A. Ltd., Wellington:

Leaflets covering the complete range of R.C.A. high-fidelity audio equipment. These include a new transcription turntable unit, the new R.C.A. Orthophonic amplifier and pre-amplifier units, the R.C.A. 8-pole variable-reluctance pick-up, and a new loudspeaker system.

R.C.A. Broadcast News, Vol. 91, October, 1956.

Philips Technical Review, Vol. 18, No. 3.

Westinghouse Engineer, January, 1957.

A.T.E. Journal, Vol. 12, No. 4, October, 1956.

N.Z. Electrical and Radio Trader, January, 1957.

R.C.A. Newsletter, November 2, 1956.

Pye Telecommunications Newsletter, December, 1956.

P.H. Brans Equivalent Radio Tubes Vade-Mecum, 13th edition.

Philips Telecommunications (all original).

Mullard News Letter, No. 16, October, 1956.

"News from EDAC", Leaflet on Philips Potentiometer Recorders.

A NOVEL INTER-COM. SWITCHING ARRANGEMENT

The circuit to be described in this article is one which enables an inter-com. system with a single master station to have some of the flexibility of those systems which use multiple masters.

Introduction

In an inter-com. system which has only one master station, it is usually possible for any out-station to call the master, and for the master to call any out-stations, but only one at a time. It is possible, too, to arrange things so that there are no calling facilities from the out-stations to the master, although talking back is possible, with the talk/listen function controlled from the master, and not from both ends.

There is an advantage in having calls initiated only by the master station in that this requires fewer wires than when calls can be initiated from the out-stations as well. With any of the systems described, however, it is not possible for one out-station to talk to another, and, in some installations, this is a very desirable function. It can easily be arranged, of course, by making all stations masters, in which case any station can call any other station, but this system is expensive in equipment and in inter-station wiring. The system to be described here enables any out-station to talk to any other, in spite of the fact that there is only one master station. It does, however, require an extra wire from the master to at least half the stations that need the extra facility. Only one amplifier is used—the one at the master station.

What the System Does

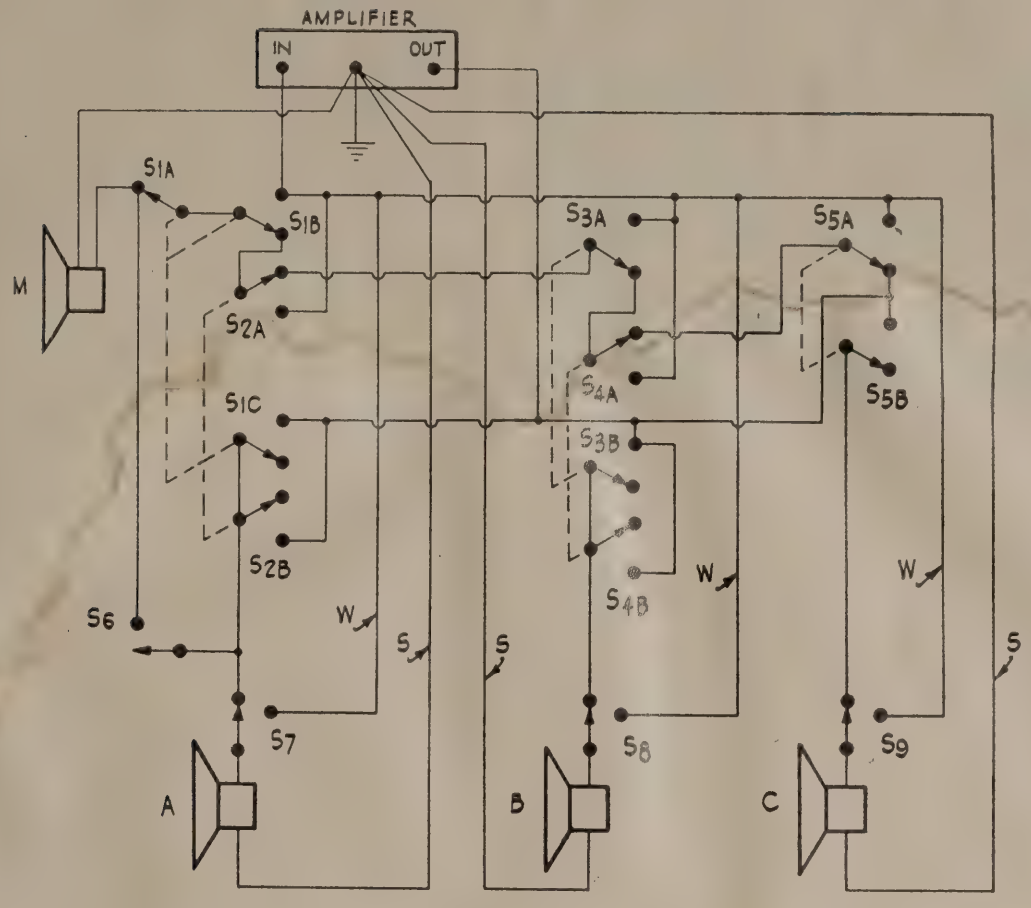
In order to explain the new system, it would perhaps be easiest to describe what the requirements were that led us to devise it. Actually, the requirements were fairly simple. They called for a master, and three out-stations, each of which was to be able to initiate calls to the master. The additional requirement was that two of the out-stations, if necessary, be able to talk to each other. The circuit given here does just this, but at the outset it should be explained that it would be possible to arrange matters so that any of the out-stations can talk to one another—not only two, as in the circuit.

In the diagram, only the speakers, which also do duty as microphones, and their switching arrangements have been drawn in detail, the amplifier being shown simply as a block, with input, output, and earth terminals. This is because any amplifier of sufficient gain and power output will do the job, and because the circuit of the amplifier has no bearing on the arrangement of the switching circuit.

In the diagram, M is the master speaker, and A, B, and C are the remotes. Of the switches, S_6, S_7, S_8, and S_9 are located at the remote stations, while all the others are at the master. Physically, the master speaker and all the switches associated with it are housed together as a small unit, connected by wires to the amplifier. It is equally possible, of course, to build the speaker and switches into the amplifier cabinet, but the scheme used here enables the control unit to be made quite small, and the amplifier to be parked out of the way somewhere. There are only three leads from the master control box to the amplifier—an input lead, an output lead, and an earth. Similarly, there are an input lead, an output lead, and an earth going to each of the remote stations.

A and B are the stations which need to be able to talk to each other, while C is the normal type of remote. We will therefore describe C's wiring first. From C to the master, there are three wires, one labelled W, one labelled S, and an unlabelled one. "W" stands for "wire," "S" stands for "shield," and the two together comprise one shielded lead, or a piece of microphone cable in which W is the inner conductor, and S the outer. The remaining wire is an unshielded one.

S_{5a} and S_{5b} are individual sections of a Post Office lever-type switch, of the kind that automatically returns to the rest position. This position is the one in which the switch (and all the others) is drawn. Tracing the wiring then shows that in the rest position of S_5, the "hot" speaker lead is connected through its own talk/listen switch, S_9, to S_{5b}, at which point its circuit is broken. Now, if station C presses his t/l switch, his speaker is connected through the wire W to the input terminal of the amplifier, which then functions with C as a microphone. If the master station wishes to call C, he depresses S_5. Then, S_{5b} connects C to the output of the amplifier. Now, when the master presses any of the keys, to call an out-station, his speaker M must be connected to the input of the amplifier to act as a microphone. This is where S_{5a} comes in. This switch connects the input wire of the amplifier to the "hot" lead of speaker M, but it does so through switches belong to each other station. This can be seen if the common arm of S_{5a} is traced to the left, through S_{4a}, S_{3a}, S_{2a}, and S_{1b} and S_{1a}. The reason for all this is that the speaker M is different from all the others, in that it must at all times be connected to the output of the amplifier, ready to receive a call from any station which may press its t/l button. At the same time, if any one of the master's calling switches are depressed, TWO operations must take place. First, the normal connection with the amplifier output must be broken, and, secondly, M must be connected to the amplifier input to act as a mike. The first of these requirements means that M must be connected to the amplifier output not directly, but through a number of switches in series, one for each calling switch. In this way, the connection to the amplifier output is broken whichever calling switch is depressed. The only reason for making the calling switches self-returning is that this makes



the operation easier, calling being done by pressing the lever, and listening being automatically obtained by releasing it. In this respect, the lever switches resemble push-buttons.

The A and B Remotes

If all the remote stations were like C, and required no cross-calling facilities, all the remotes would have the same circuit as C, and the master's switching to them would be identical. The additional switches attached to the A and B calling switches are there solely to provide the cross-connection facility between A and B. It should be pointed out, however, that this extra facility calls only for additional switching, and that the A and B calling switches have sections which correspond exactly to S_{5a} and S_{5b}. This must be so, because when the A and B stations are called by the master, and when they themselves call the master, the required switch functions are identical with those already described for station C. Thus, S_{1b} and S_{1c} correspond exactly to S_{3a} and S_{4a} and again to S_{5a} and S_{5b}.

S_{1a}, which has so far not been mentioned, is an extra, which will be described later, and which does not come into the picture at present.

Now, S_1 and S_2 together constitute a single lever switch, and the same holds for S_3 and S_4. These are of a different kind from S_5, in that they have three positions. There is a central position, corresponding to the rest position of S_5, and there is a down position, also corresponding to the on position of S_5. Like this one, the switches, when pressed down, must be held in that position, as they return to the central position automatically, as soon as released. However, these two switches have an up position as well as a central and down position, and when they are put into the up position, they will stay there. It can be seen that these lever switches are really two switches, controlled by a common lever. They are arranged so that, when the lever is put in one position, the switches associated with the opposite position do not move. Thus, referring to the diagram, S_1 switches all remain in the position shown, when the lever moves up, so as to operate S_2 switches. Similarly, the S_3 sections remain in their drawn positions when the lever is up, and operating the S_4 sections.

When the A calling lever is moved down, S_2 operates. S_{2a}, which is in series with S_{1b}, S_{3a}, and S_{5a}, breaks the connection between the amplifier output and the speaker M. At the same time, S_{2b} connects speaker A to the amplifier output. This is the normal calling function of the master station. Now, when the calling lever is moved to the up position, S_{1b} breaks the connection from M to the amplifier output, and S_{1c} connects A to the output of the amplifier. It will be seen that these functions are exactly the same as when the

switch S_2 is operated, the only difference being that, when S_1 is operated, the lever will stay in that position until manually returned to the rest position.

Now, at station B, S_3 and S_4 again do identical jobs, with the same exception—namely, that in one of them the lever is self-returning, and in the other it is not. It is thus possible for the master operator to press either the A or B lever (or both) to the up position, and leave them that way. Now let us see what happens if this is done.

If S_1 and S_4 are operated together and left in that position, but A and B speakers are connected to the output line of the amplifier. Now, if A presses S_7, his talk/listen switch, his speaker is connected to the amplifier input, and he is heard by B. Similarly, if B presses S_8, he is heard by A. In this way, A and B can carry on a conversation between them, each using his switch for press-to-talk, and release-to-listen. In the normal course of events, when the master station presses any of the calling switches, his speaker M is connected as a microphone. Thus, unless something is done about it, M will be connected as a mike, while A and B are interconnected. This is undesirable, because, whatever noise was present in M's room would then be superimposed on the conversation between A and B. This is where S_{1a} comes in. When the operator pushes A's calling lever into the up position, operating S_1, the speaker M becomes disconnected from the system altogether, so that M neither overhears the conversation between A and B, nor is his microphone open, causing interference.

It can now be seen that the system works in this way. If A wants to talk to B, or vice versa, the one initiating the call asks M to connect him through to the other. M then pushes the A and B levers into the up position, where they stay, and A and B can now communicate. If no other facilities were provided, the master would never know whether A and B have finished, so that the normal positions of the switches can be restored. To get over this difficulty, A is provided with an extra wire (unshielded) which goes from the "hot" terminal of the M speaker to S_6, which is an extra push-button at station A. If A presses S_6 and S_7 simultaneously, he connects speaker M to the amplifier output, so that, when he talks again, he is heard by the master. He then tells the master that he is finished with B, and the operator puts all switches into the normal position.

With this system, the situation can arise that A and B are talking to each other, and someone else wants to say something to someone. If C, or any other outstation, presses his t/l switch and talks, he will be heard by A or B, whichever happens to have his speaker working at the time. A can then inform the operator that C is calling, and the operator can adjust the switches accordingly. If the operator wants to call someone while A and B are interconnected, he has only to flip the A and B levers down, say his piece, and, if desired, restore the A-B connection when he has finished.

From this somewhat length description, it can be seen that all contingencies have been provided for. Perhaps the only disadvantage of the system is that A or B must call the master station if either of them wants to talk to the other. As against this, the wiring and the amount of equipment are much less formidable than if complete flexibility is given by making all the stations masters. There is thus a very considerable saving of money. If more than two out-stations want the ability to talk to each other, this can easily be done by giving all of them the same switching arrangements at the master station as A has in this example. Then, any two of the outstations so fitted can be put in touch with any of the others, and any of them can call the master and tell them to restore the connections to normal. In practice, S_7, S_8, S_9, and S_6 can all be push-buttons, or they can be lever switches with automatic return springing.

Earthing

It should be noted that there is only one common earth-point for the whole system. The shielded wires from all out-stations are connected together only at the amplifier chassis, and only at the common earth-point for the valve circuits at that. If the earths are connected in any other way, there is a strong probability that when certain buttons are pressed, feedback howls will take place. For instance, if C is farther away from M than B, it might be thought possible to save shielded cable by joining the shield S to that of B, at B's position. If this is done, all will probably work properly except when A and B are interconnected, and C wants to break in on them, as described above. There would then be a long piece of common earth wire between B, C, and the master, so that when B was on to listen, and C pressed to talk, the feedback howl would occur.

As long as these earthing precautions are taken, there need be no fear that things will not function properly. If mistakes are made in the wiring, these will show up very readily when the system is tried out, and after a complete check of what does work properly, and what happens that should not, it will be easy to

SPECIAL OFFER

R. & E. TAPE RECORDING SERIES

The recent series of articles describing circuits for use with "Collaro," "Truvox," and "Brenell" tape decks has proved so popular that we are making a special offer to those who want to purchase the complete set of five issues containing the articles. The special price will be:

7/11 post free

FOR THE SET OF FIVE ISSUES ONLY

OBTAINABLE ONLY FROM

RADIO & ELECTRONICS (N.Z.) Ltd.

P.O. Box 6361 WELLINGTON

63 Abel Smith Street WELLINGTON

AUSTRALIAN TV RECEIVED IN NEW ZEALAND

On 1st December last, the first Australian television signals were viewed in New Zealand by Messrs. M. Wills and D. Jackson, of Invercargill. This was the culmination of an idea which occurred to Maurice Wills approximately six months earlier, that the Bandl television signals from Australia should be received here under conditions of sporadic E-layer propagation. Accordingly, help was sought from Ralph Slade, who agreed that the idea was feasible, and who was instrumental in bringing over an Australian-built Philips TV receiver for the purpose. This arrived in good order and condition, and was installed in the Wills' "ham" shack only four days before the first signals were seen.

The technique used was to employ an ordinary narrow-band receiver (actually a modified 5-metre amateur receiver) for search purposes. This enabled the FM sound carrier to be picked up, if not very understandably, since it was an AM receiver, and also the 50-cycle buzz of the vertical synchronizing pulses. When these were received at good strength, the aerial was transferred to the TV set so that the picture could be viewed.

Olympic Games First

On 1st December, the narrow-band receiver picked up weak signals at 6.35 New Zealand time, and by 7.15 they had grown strong enough for a picture to be obtained. As the signal strength gradually came up, the first sign of the picture (which would not be synchronized at first) was the horizontal dark bar representing the vertical blanking periods, and, once synchronization was obtained, the picture was of excellent quality, and turned out to be some of the Olympic Games telecasts.

This first reception has been followed by many other occasions when good pictures have been received. Typical of these is the test card, a reproduction of which is given on this page. This is an un-retouched photograph from the screen of the TV receiver in Invercargill, and shows excellent definition, though this is marred somewhat by noise, giving rise to the "smow," as the Americans call it.

Some Technical Details

There are two Australian stations using the channel on which Messrs Wills and Jackson have been successful, one in Sydney and the other in Melbourne. The vision carrier is on 64.25 mc/sec., and the sound carrier is on 69.25 mc/sec. It is purely a matter of chance, therefore, which of the two transmissions is received. On some occasions the sound has come through without a strong enough signal for a picture, and, strangely enough, there have also been times when the picture has been received but no sound. Also, both the Sydney and Melbourne stations have been picked up. Sometimes the one, sometimes the other, and sometimes both together. Even the last possibility has actually been experienced—i.e., the sound belonging to one station, but with the other's picture!

Test pattern received in Invercargill and photographed direct from the screen of the TV receiver.

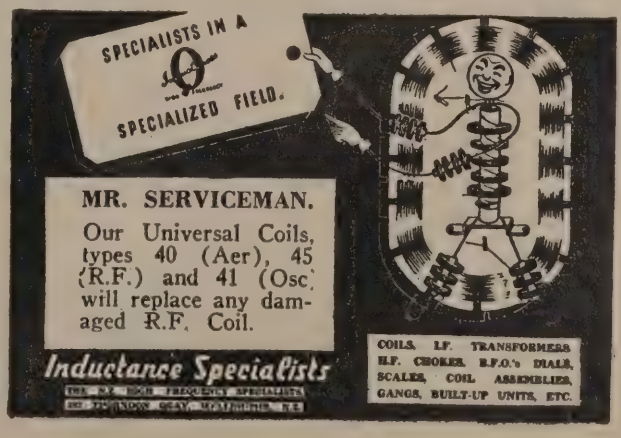
It is worth noting that strength 7 and better signals have been received on a simple 3-element wide-spaced beam aerial. The TV receiver has been used "as is," without the addition of a nylow-noise pre-amplifier or other refinements. The aerial was cut for 65 mc/sec., and is matched to a 300-ohm transmission line by the T-match method.

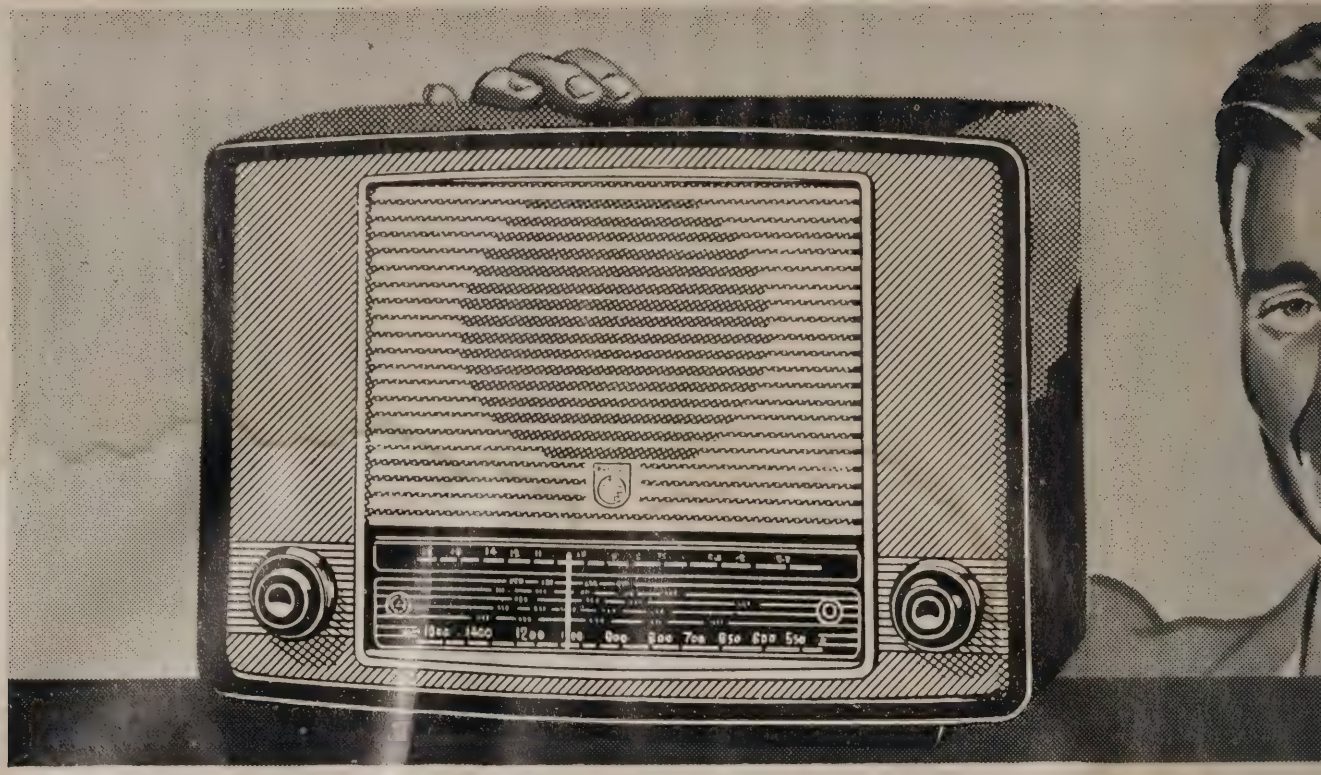
Both the stations on this frequency are the A.B.C. non-commercial ones. The commercial stations are on a much higher frequency—in the vicinity of 200 mc/sec., in Band III, and it is very unlikely indeed that we will be able to receive them here, except by the remote chance that ionospheric scatter may do the trick.

The A.B.C.'s transmission times at present are: 3.30 to 4 p.m., 5.30 to 6 p.m., and 7 to 10 p.m. Eastern standard time.

There is no doubt that Invercargill is one of the best places in New Zealand for attempting this sort of thing, but already there are reports of Australian TV reception at Paekakariki, and there seems to be little reasons why success should not attend attempts in other places.

We would like to congratulate Messrs Wills and Jackson on their pioneering effort, and extend to them the hope that it will not be too long before they are able to try their hand at some TV reception from not quite so far away!


SPECIALISTS IN A
SPECIALIZED FIELD.
MR. SERVICEMAN.
Our Universal Coils, types 40 (Aer), 45 (R.F.) and 41 (Osc) will replace any damaged R.F. Coil.
Inductance Specialists
COILS, I.F. TRANSFORMERS R.F. CHOKES, B.F.O.'s DIALS, SCALES, COIL ASSEMBLIES, GANGS, BUILT-UP UNITS, ETC.



NOW OFFER YOUR CUSTOMERS THE

PHILIPS *International* T.V. COMPANION

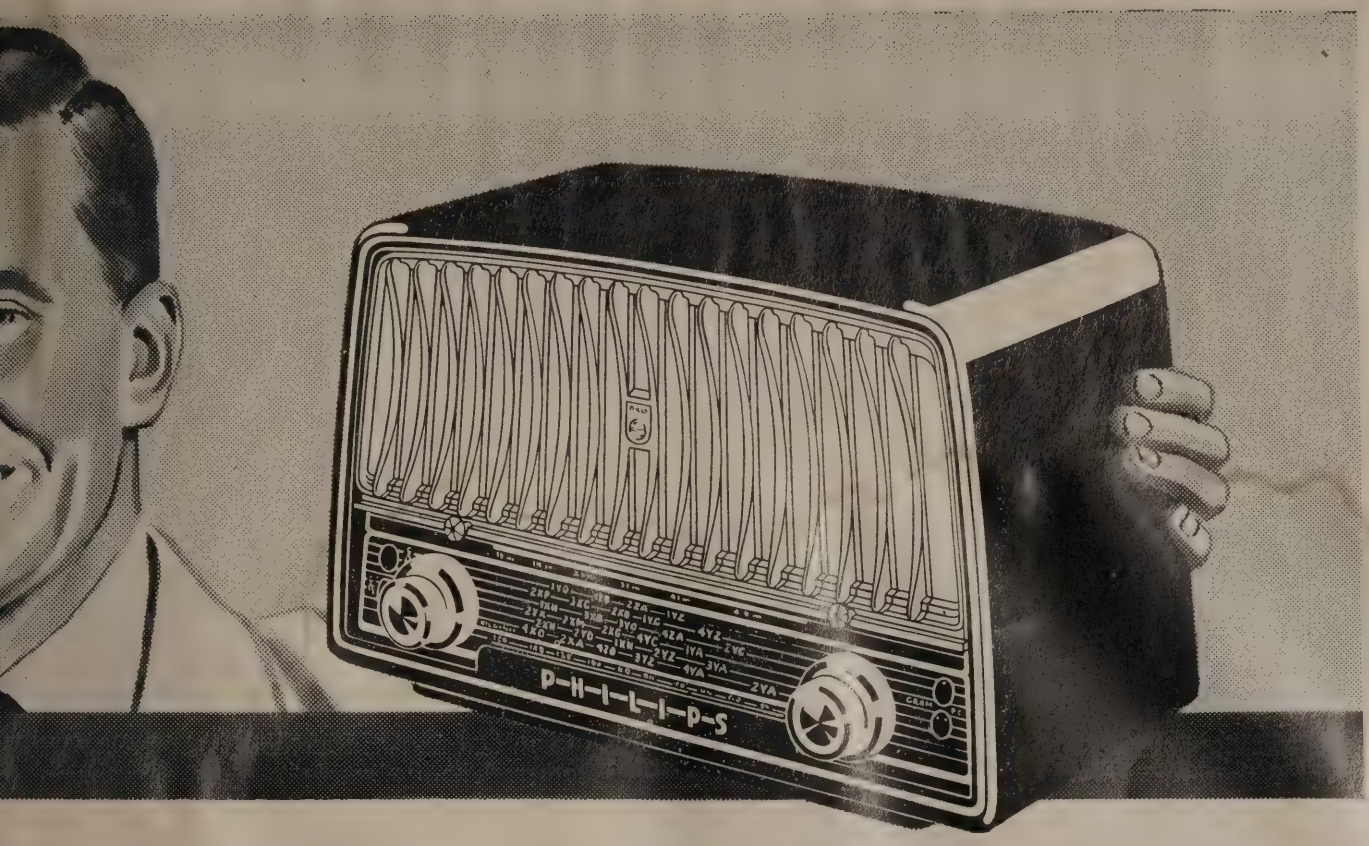
- Attractive three-tone cabinet with contrasting trim designed to match your future TV receiver.
- World range with separate aerial and earth terminals for low-powered distant station reception.
- Large, easy-to-read dial, wave-band indication.
- Eight-valve performance from five powerful multi-function valves.
- New 6 in. true fidelity Philips Ticonal Speaker.
- Built-in Ferrite rod aerial. Pick-up terminals for record player or Philips tape-recorder.
- Extension speaker terminals.

RETAIL PRICE: 28 gns.

PHILIPS

PHILIPS *NOVOSON*

PHILIPS ELECTRICAL INDUSTRIES OF



ALISM OF *NOVOSONIC** LISTENING

PHILIPS *New Yorker*

- **First introduction in New Zealand of built-in suppression filter to cut mains noise**
- **Room-to-room portability with the world at your fingertips.**
- **3-way aerial system: (1) Built-in Ferrite rod aerial for broadcast reception.**
  (2) Built-in plate aerial for shortwave.
  (3) External aerial and earth connection for reception of distant low-powered stations.
- **Gram pick-up terminals specially connected for optimum quality.**
- **Seven-valve performance from five new powerful multi-function Noval valves.**

RETAIL PRICE 24 gns.

What is NOVOSONIC?

Novosonic literally means "new sound." It is the new living sound that results from all the recent improvements that are now being built into Philips radios. Some of the components that contribute to NOVOSONIC listening are Philips new Ferrite materials (used in coils, built-in rod aerials, and I.F. transformers.); Philips multi-function Noval valves, giving extra audio power; better, wider range speakers; and, of course, acoustically planned cabinets.

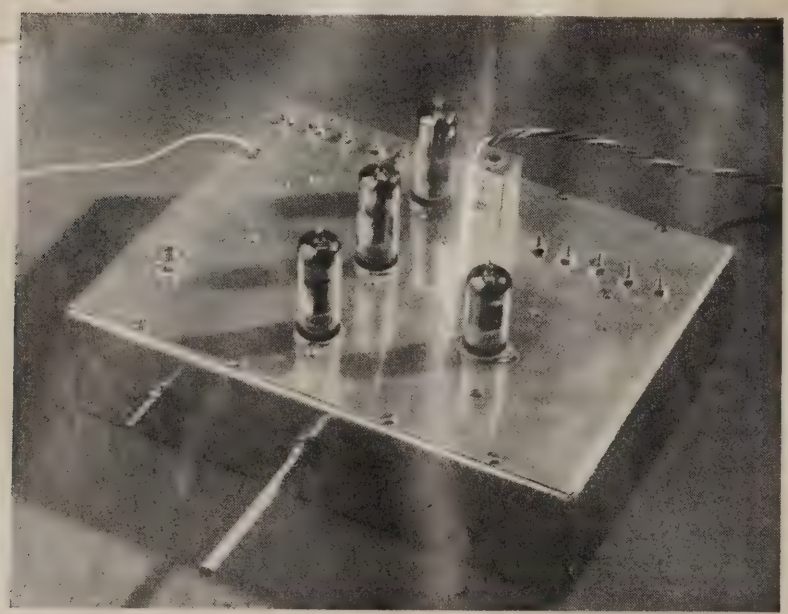
RADIOS

ZEALAND LIMITED

RECEIVERS

HIGH-QUALITY BROADCAST-BAND RECEPTION

We have been asked to print an article on this subject, expounding the problems to be overcome in the design of high-quality broadcast tuners, and the methods used in attempts to solve them. Reference is made to all the stock methods, their virtues and limitations, and some attempt is made to recommend the type of tuner that should be used for various sets of circumstances.



Is the synchrodyne, of which the illustration shows a typical example, the only solution to the hi-fi receiver problem?

Introduction

Some of our regular readers may wonder why we are entering upon a general discussion of a problem for which, over a period, this journal has published several attempted solutions, each with its own features to recommend it. In point of fact, it is the numerous circuits that appear from time to time in the techincal press that have partly been responsible, because, when each is written up, its advantages and disadvantages are stressed, so that the reader might be forgiven for thinking that each and every method used is as good as the next. Indeed, without collecting a large number of such articles, and analysing them carefully, it is very difficult for the layman to evaluate the worth of the various methods used for designing high-quality tuners. Even if this is done, the approaches of different authors may in themselves be misleading, because some have a human, but unscientific, tendency to stress the good features of their own story without giving due prominence to its disadvantages!

Radio and Electrical Review, however, can lay some claim to impartiality in the matter, because this journal has, over a long period, published a large number of differing designs, covering almost all the possibilities; not only have we tried them all, but, by having done so and published the results where this seemed warranted, we should be able to avoid criticism on the score of bias towards one method or another. The findings given towards the end of this article are the result of much thought over a long period, allied to a good deal of practical work on the subject, and we hope that they will be found useful by all those interested in high-quality broadcast reception, from whatever standpoint.

The Basic Problem

In the first place, let us see what difficulties confront the would-be designer of a high-quality broadcast band tuner, and why these difficulties exist. In some ways, the production of a high-quality transmission of music at almost any radio frequency is simpler than the corresponding task of receiving the same signal without spoiling its characteristics, so, for a start, it should be instructive to ask what constitutes a high-quality signal, transmitted on a particular radio frequency.

Let us assume that we already have an excellent audio signal, produced by a microphone or gramophone pick-up, and amplified to a suitable level by the studio equipment, for transmission over land-lines to the transmitting station. There is little difficulty in producing such an audio signal with any required degree of fidelity, which, in technical terms, means a frequency response from, say, 30 c/sec. up to the upper limit of audibility—say, 15,000 c/sec., together with a total distortion that is a small fraction of 1 per cent. in terms of total harmonics. If such a signal is applied to a power amplifier and loudspeaker system of the highest quality, we will have what is commonly defined today as high-fidelity reproduction of the original sound. Unfortunately, only those in direct contact with the studio equipment are able to do this, so that most of us must rely on radio transmission of the signal, and picking it up on some form of radio receiver,

before we can apply it to our own high-quality audio equipment, which may well be almost as good as that available in the broadcasting studios. Any deterioration that can be detected as a result of radio transmission and reception then has to be accepted as unavoidable. Such deterioration can clearly be divided into two parts—that due to the transmission process, and that caused by the receiver. Over the first we have no control whatever, since it is a function solely of the standards of quality maintained by the broadcasting authority; over the second, we have full control, as we are free to use any reception technique that engineering may have been able to think up over the now quite long period that has elapsed since broadcasting began.

It is essential to realize at the outset, then, that our reception can never be better than the quality of the transmissions. On the broadcast band, it is not permissible to transmit frequencies up to the upper limit of audibility, because, if this were done, it would prevent stations on the broadcast band from being so closely spaced. It would then be impossible to accommodate so many stations on the band, and this is a serious matter, because for many years now there has been a greater demand for channel space than there is space available. *It is this necessity for spacing stations as closely together as possible that is a fundamental cause of difficulty in transmitting and receiving signals of the highest possible quality on the broadcast band.* As we shall see later, close spacing of broadcast stations on the band causes much more difficulty at the receiving end than at the transmitter when high-fidelity reception is attempted.

Why Space is Required

For many years, it was not realized, even by engineers, that when a radio frequency carrier is modulated, the resulting transmission takes up an appreciable amount of space in the radio spectrum. As long as the carrier is not modulated, the room it takes up is determined only by the stability with which the carrier's frequency can be generated, and since radio frequencies can be generated quite easily with an accuracy of one or two parts in a million, it would be possible to space unmodulated carriers so closely that the ability of the receiver to pick out any particular one of a closely spaced group of signals would be the limiting factor. This ability on the part of the receiver is termed its selectivity.

But the moment a carrier is modulated, new frequencies are generated. These frequencies turn up on either side of the carrier frequency, and they bear a very simple numerical relationship with the carrier frequency and the frequency of the modulation. If, for example, the carrier is modulated with a 1000 c/sec. tone the new frequencies are equal to $(f_c + 1000)$ c/sec. and $(f_c - 1000)$ c/sec. Thus, the modulated signal extends from the higher of these two frequencies to the lower. If the modulation is not a simple tone, but consists of a number of frequencies (as is true when the modulation is music), each audio frequency present at a given instant is represented in the modulated signal by its own radio frequency, which bears the same relationship to the carrier as in the example above. It is easily seen, therefore, that, if the modulating audio signal contains components up to 15,000 c/sec., the resulting R.F. signal will extend from 15 kc/sec. less than the carrier frequency to 15 kc/sec. higher than the carrier.

Now, if the original modulating signal is to be regenerated in the receiver, the latter must be able to amplify equally well the whole band of frequencies that can be occupied by the modulated signal sent out by the transmitter. If the receiver's amplification is less towards frequencies representing the higher modulation components than it is towards the carrier and the low-frequency modulation components, the detector output may contain some of the higher modulation frequencies, but their amplitude will not be as great in comparison with that of the lower modulation frequencies as it originally was in the modulating signal fed to the transmitter. In other words, the higher audio frequencies will be partially missing from the receiver's audio output. Indeed, the difficulty with conventional receivers is not to lose the higher audio frequencies altogether, so that even if the transmitter is modulated with frequencies up to 15,000 c/sec., it by no means follows that the receiver will be able to reproduce them.

Why This Receiver Difficulty?

The question now may be asked why the existence of a band of frequencies around the carrier should cause this difficulty at the receiving end. The answer has already been indicated, but in case some readers should not have spotted it, we had better say what it is. It is the need for selectivity. If the need for selectivity did not exist, as it would not if there were only one or two stations occupying the broadcast band, building a receiver which amplifies evenly over the whole band taken up by one transmitter would not present too much difficulty, but, as it is, there are signals on the broadcast band every few kilocycles. If, therefore, we build a receiver the radio frequency response of which is broad enough to take in without attenuation the carrier and all the added frequencies representing the modulation, it will take in and amplify not only the signal we want, but also one or more adjacent signals as well. The result will be that, as well as the modulation of the desired station, we will hear that of one or more others at the same time—a regular jumble that will hardly lead to pleasurable listening! The only cure for this is to increase the selectivity of the receiver, and this means simply narrowing the band of frequencies to which it responds equally well. And here is the crux of the matter. There are always undesired signals so close to the desired one that for this increase of selectivity to be effective in removing the interfering ones, it cannot help attenuating those radio frequencies that carry the high modulation frequencies of the signal we are trying to receive.

In short, selectivity on the one hand, and a wide pass-band on the other, are mutually incompatible. It would appear, then, that the problem of receiving a

transmission well enough to give high-fidelity reproduction is insoluble from the start!

Something Can Be Done

This is why high-quality radio reception is so difficult to achieve, and why so many people have spent so long devising methods by which it can be, at least in part. It also explains why it is of little advantage to take the output of the radio tuner section of a conventional commercial receiver and feed it to a high-fidelity audio amplifier and speaker. The tuner has cut off so much of the high-frequency end of the audio signal that the best audio equipment can never restore its former response—the way it sounded before it was fed to the transmitter. Note carefully that it is the receiver that is the main offender, not the transmitter, for there is little to prevent the highest audio frequencies from being modulated on to the carrier.

The situation is not hopeless, though. To a very large extent, the day is saved by the fact that when a signal is very strong—as it usually is from a local station—a receiver does not need to be nearly as selective as when the wanted signal is weak. This enables us to use, for high-quality reception, a special tuner which is much too inselective for any purpose other than local-station reception. It is upon this fact that almost all attempts to design high-quality tuners are based, so let us see where it leads us when we try to cash in on it.

Various Alternatives

Having decided that too much selectivity is the nigger in the wood-pile, it does not take much imagination to think up a few possible methods whereby a relatively inselective receiver may be built. Perhaps the most obvious is the crystal set. As a rule, this has only one tuned circuit, and so is very inselective indeed, and should fill the bill admirably. If one substitutes for its headphones a $\frac{1}{2}$-Meg. resistor, shunted by, say, 100 $\mu\mu$f., the output can be fed to the input terminals of any high-quality amplifier, or at least to the pre-amplifier belonging to it. In this way we can make up for its small output voltage, even when it has only a short aerial. Unfortunately, if this scheme is tried, it is soon found to fall far short of high-quality requirements. In most situations it is not selective enough to prevent interference from other local stations, even though they may be several hundred kilocycles away from the desired station. This can sometimes be cured by using a very short aerial, which increases the selectivity, and may enable the set to split the local stations well enough. If this is achieved, there may well be excited cries of delight at the extended frequency response—at first. After a while, however, and especially if the audio equipment is really good, it will be found that the results are not exactly pleasing to listen to. There is a "muddy" sound about the middle register, and the upper register does not sound clean. These effects are due to distortion, which, seeing the tuner is so simple, can be directly attributed to the detector. Exchanging the crystal diode for a thermionic one does not cure the trouble, and generally adds hum to the list of imperfections, since the output is very small.

The distortion arises because the R.F. input to the detector is very small. Diode detection is reasonably distortionless only when the R.F. signal is several volts in amplitude. When the signal is small—a volt or less—detection takes place on the bottom end of the diode's characteristic, and the output contains considerable quantities of second harmonic distortion. Since the signal is a complex one containing a large number of frequencies, the most disturbing effect of the non-linear type of detection is the production of intermodulation products, which are responsible for the unpleasantness of the sound of the output.

HIGH-FIDELITY AMPLIFIERS

THE N709 ULTRA-LINEAR 14-WATT AMPLIFIER AND TONE CONTROL UNIT NOW AVAILABLE

Advance details obtainable now

N709 6½-watt High Quality Triode Amplifier and Tone Control Unit

EL34 17-watt High Quality Pentode Amplifier and Tone Control Unit

KT66 32-watt High Quality Ultra-Linear Amplifier and Tone Control Unit

EL34 32-watt High Quality Ultra-Linear Amplifier and Tone Control Unit

RADIO-TUNER and complete Radiogram High-Fidelity Units

RADIO-TUNERS

BROADCAST PRE-SELECTOR, ALSO IN DUAL WAVE

DUAL-WAVE WITH R.F. STAGE

TRIPLE-WAVE WITH R.F. STAGE

ALL-WAVE BANDSPREAD

All tuners can be used with the above amplifiers, and have an I.F. Bandwidth variable from 10 kc. to 20 kc. (switched), and built-in power supply.

RADIO-GRAM UNITS

All radio sections as for tuners, but combined with any of the High Fidelity Amplifiers above.

Single, two, or three-unit chassis available.

All these Models

REASONABLY PRICED

TOPS IN PERFORMANCE

12 Months' Guarantee — Cash or Terms — Excellent After Sales Service

Demonstrations Models Available in Three Weeks

HIGH-FIDELITY SOUND SYSTEMS

PHONE 5251 NEW PLYMOUTH 4 TOTHILL STREET

Thus, even when the lack of selectivity is not a problem, the distortion present in the output prevents the wide frequency response from being made use of. It should be mentioned that there is still current in some quarters a belief that a crystal detector is free from distortion. This idea has persisted from the early days of radio when a crystal set, heard on a pair of headphones, sounded very distortion-free compared with the rudimentary amplifiers and loudspeakers of the day. Unfortunately, there is no truth in it, whatever may be said on the subject.

The T.R.F. Tuner

The next most obvious qualifier in the search for inselectivity is the Tuned Radio Frequency, or T.R.F. receiver. This comprises one or more tuned stages of radio frequency amplification, and, usually, a diode detector. Broadly speaking, it suffers from the same defects as the crystal set. However, it can be made more selective than the latter, and can be made to have less distortion, under favourable conditions. Where there is only one R.F. amplifier valve, there are usually two tuned circuits, one between the aerial terminal and the grid of the valve, and the other between the plate circuit of the valve and the detector diode. The presence of two tuned circuits accounts for the increased selectivity, and it can be said that this arrangement will usually provide enough selectivity to separate the local stations from each other quite well. Its main difficulties are, once more, detector distortion, and, oddly enough, selectivity.

The difficulty with detector distortion arises this time because it is not feasible to apply automatic gain control to the R.F. amplifier valve. Thus, strong signals are likely to overload the stage to the extent of producing distortion of the R.F. signal, while weak ones will give a distorted output through not supplying a strong enough signal to the diode detector. These things can be overcome only by the use of a manual R.F. gain control, which must be manipulated in conjunction with the audio volume control in such a way that neither of these faults occur on any of the stations to be received. Since there is no accurate means of assessing the settings of these controls, one is very likely to have considerable distortion present in spite of everything.

The selectivity problem is a twofold one. In short, two tuned circuits at the signal frequency are usually too selective for the purpose in hand—namely, allowing the sidebands, up to 10 kc/sec. and higher, to come through to the detector without attenuation. Many people find this difficult to believe, but it is a fact nevertheless. There is a simple relationship between the selectivity of a tuned circuit, the frequency to which it is tuned, and its Q, which says that for values of Q greater than about 5,

$$B.W. = \frac{f}{Q}$$

where $B.W.$ is the bandwidth between points on the selectivity curve that are 3 decibels down on the response at the peak of the curve,
f is the frequency of the peak (the tuned frequency of the circuit), and
Q is the numerical value of the Q of the circuit.

Coils used in radio sets frequently have Q-values well in excess of 100, so let us assume, so as not to paint too black a picture, that both tuned circuits in the simple T.R.F. have a Q of 50. In actual fact, a Q as low as this would not be likely unless the tuned circuit were purposely shunted by resistance in order to reduce the natural Q of the circuit. However, if we have two circuits with a Q of 50, and if the frequency is 1000 kc/sec., about the middle of the broadcast band, the bandwidth of each circuit would be 20 kc/sec. This means that the response of each circuit would be 3 db. down at frequencies 10 kc/sec. off resonance. The two circuits in conjunction would give a response that was 6 db. down at 10 kc. off. That is to say, the response to the R.F. components that represent 10 kc/sec. modulation would be only half what it should be, and the effective A.F. response of the arrangement would be 6 db. down at 10,000 c/sec. Nor is this all.

We have assumed in the above example that the frequency is 1000 kc/sec. At the lower end of the band —say, at 600 kc/sec.—the same value of Q will give a response that is 6 db. down at only 6 kc/sec., and this is hardly the flat-to-10 kc. sort of response we originally set out to get! At the high end of the band, of course, things would be better, and the response would be 6 db. down at 15 kc/sec. The main point to be brought out here is that the performance of such a tuner varies widely over the broadcast band, and, although it can be good, from the bandwidth point of view at least, at the high-frequency end of the band, it can at the same time be downright poor at the low end of the band. And, remember, the case we have taken for calculation is one that you will hardly ever find in practice, because the builder of a T.R.F. seldom goes to the length of shunting his coils with resistance.

There is another bugbear, too. It has been assumed in the foregoing paragraph that all is well with the circuit and with its stability. It frequently happens that scant attention is given to the construction of such a simple and apparently elementary thing as a single-stage T.R.F. tuner, with the result that a certain amount of regeneration is present, even if the circuit doesn't actually oscillate. If this should be the case, the response of the tuner will be much more peaked than it should be, and so will not have even as much bandwidth as the calculation might lead one to expect. Added to which, the curve will be unsymmetrical, causing one sideband to be amplified more than the other. This will cause distortion in the audio output quite separately from any that may arise in the R.F. amplifier tube or in the detector circuit.

If we have painted a somewhat grim picture of what even the simplest T.R.F. may do, it is no more than what can, and often does, happen, especially when such

a circuit is carelessly thrown together on the theory that in such a simple arrangement there is nothing that can go wrong! At any rate, the considerations put forward under this heading at least serve to show that the T.R.F. tuner is by no means the answer to the problem. Incidentally, when two tuned stages of amplification are used, there will not be anything like the requisite bandwidth, even when regeneration is completely absent.

The Superhet Tuner

At first sight, the superhet might seem to be even less promising than the T.R.F. for obtaining extra bandwidth, because it usually has at least one tuned circuit on the signal frequency, followed by an I.F. amplifier which has at least four tuned circuits. Fortunately, however, there is a possibility of obtaining much more desirable characteristics than the T.R.F. can ever give. This possibility is based on the fact that the selectivity of a superheterodyne exists mainly in the I.F. amplifier, which works at a fixed frequency, irrespective of the signal frequency. The first advantage of the superhet is thus that, whatever the shape of the pass-band that we actually achieve, this shape is much more likely to be constant over the whole broadcast band. Then, again, the existence of four tuned circuits (since they *are* all tuned to the same frequency) actually helps us to increase the band-width, and at the same time to secure reasonably good rejection of signals that are just outside this pass band.

This may seem entirely contradictory, but it is not so, as we hope to show shortly. If a diagram is drawn of two selectivity curves, one for two tuned circuits, arranged as in a T.R.F., with an amplifier valve between them, and the other for two identical circuits coupled together as in an I.F. transformer, it will be noted that at frequencies a long way from resonance, the slopes of the sides, or skirts of the two curves as they are usually called, are identical. This indicates that either arrangement can be equally good at rejecting signals that are a few kilocycles away from the edge of the desired pass band. The curve for the two coupled circuits, however, has a small portion in the middle, round about the tuned frequency, where the response is quite flat, whereas the separated circuits' response starts to fall off right from the centre frequency. Furthermore, the range of frequencies over which the coupled circuits' gain is less than 1 db. down is very much wider than the corresponding range for the separated circuits. Thus, the use of coupled circuits begins to look just a little bit like the right answer—namely, a flat response over the range of frequencies covered by the signal components, and no response at all beyond the confines of the signal. If such a flat-topped, vertical-sided response curve were possible, our search for simultaneous bandwidth and selectivity would be over! Unfortunately, however, such is not the case, although we can do better than has so far been indicated.

By increasing the coupling between the two tuned circuits, the response curve can be made to look better still. Here, it would be noticed, a small dip occurs in the response at the centre frequency, and two peaks have appeared, symmetrically disposed about it. Also, the region of approximately flat response has increased in width, while the shape of the skirts has hardly altered. If the coupling is still further increased, the peaks move farther apart, and the dip in the centre becomes more pronounced. There is very little limit to the widening of the pass-band that can be obtained in this way, other than the deepening of the central dip. If this becomes very great, the effect will be that within the pass band, the higher modulation components will be amplified more than the lower ones, and this will result in an audio response rising with frequency unless something is done about it.

It is possible to do this by including a further tuned circuit (or coupled pair) whose response is peaked at the centre frequency. If the Q and coupling of the second pair of circuits are correctly proportioned, it is possible to fill up the dip in such a way that, although the response inside the pass band is not flat, the variations that do occur are not more than 1 db. or so in depth. This would not be noticeable by ear, so that the response would effectively be flat from the centre frequency to somewhat more than the frequencies of the outer peaks.

In brief, then, an approach to the ideal selectivity curve can be obtained in the I.F. amplifier of a superheterodyne by over-coupling the windings of the first I.F. transformer so that a rather too great dip is produced at the centre frequency, and then filling in this dip by correctly choosing the characteristics of the second I.F. transformer. In actual practice, it is found that, without too much difficulty, an I.F. amplifier can be given a response that results in an audio response flat to 8 kc/sec., while, with somewhat more trouble, the bandwidth can be extended to give audio response to 10 or 12 kc/sec.

So far, we have been discussing only the response of the I.F. amplifier. This is relatively easy to organize, because the frequency is fixed, but a certain amount of complication ensues when the "front end" of the superhet is added. The difficulty is that there must be at least one tuned circuit at the signal frequency, and the trouble is, as we have already seen, that the characteristics of this circuit vary over the broadcast band. It might be thought that the aerial circuit, in a superhet without an R.F. amplifier stage, would be too inselective to affect the overall response curve of the receiver, once the response of the I.F. amplifier has been fixed, but this is not so. Things would not be quite so bad if the aerial circuit were manually tuned. As it is, it is ganged with the tuning of the oscillator, which determines the point to which the aerial section of the gang is set when a station is tuned in. Thus, unless the tracking of the aerial circuit with the oscillator is perfect (which it never is), there will be only three points on the dial at which the aerial circuit is tuned to exactly the correct frequency. It might be thought that this will not be very important, because, in a correctly aligned set, the mis-tuning due to tracking error is very slight.

Actually, though, the slight mis-tuning can have quite a marked effect on the overall response curve of the set, causing the pass band to become unsymmetrical, in such a way that the flat top slopes from one side to the other, or, in bad cases, causing one peak to become very much higher than the other. As usual, the effect of this on the response of the tuner is not so important as its effect on the distortion produced by it. This kind of distortion can be quite severe, and is the limiting factor with the broad-banded superhet kind of tuner we have been describing.

Although we have not mentioned it, the kind of tuner we have been describing is one which retains the normal intermediate frequency in the neighbourhood of 455 kc/sec. It is usually combined with a normal tuner by the simple expedient of making the broad-banding optional, by means of a selectivity switch, giving two positions: broad, for local high-quality reception, and narrow for distant and/or shortwave reception. The switching usually increases the coupling between the windings of one or both of the I.F. transformers to give the broad position.

Another Type of Superhet

So much for what is really a modification of a conventional tuner. There is another approach with a superhet, and that is to build a special one with entirely different characteristics, specially for local-station reception with high-quality performance. This can be done very much more simply than the bandwidth-switching type, merely by choosing an unusual intermediate frequency for the I.F. amplifier. If, for example, the I.F. is chosen higher than the broadcast band instead of lower, as is usual, it will automatically be much less selective than a 455 kc/sec. one, even if the Q of its circuits is just as high. A suitable frequency, for which I.F. transformers exist that can be used without modification, is 1800 kc/sec. This is far enough above the high end of the broadcast band not to give trouble, and can be obtained without making special I.F. transformers, simply by re-tuning transformers whose nominal frequency is 1600 kc/sec. A tuner such as this will give an audio response that is 3 db. down at approximately 8 kc/sec., and can be made to have very low distortion provided that the station tuning is pre-set, preferably by means of a wave-change type of selector switch. In this way, tracking difficulties are avoided altogether, and, although the overall response is round rather than flat-topped, the performance is excellent from the distortion point of view, as long as a well-designed detector circuit is used. This type of tuner offers little difficulty either in design or construction, and, although slightly wider pass bands can be had with the two-point selectivity 455 kc/sec. system, the high-I.F. scheme is very much better from the distortion angle than any of the schemes so far described. Actual measurements on one constructed in our laboratory gave figures of less than 3 per cent. at 90 per cent. modulation for all modulation frequencies up to 8 kc/sec., and this is very much better than is obtained by the best of the other systems, except the 455 kc/sec. superhet when right at one of the points of perfect tracking. Both kinds of superhet have the advantage that their overall gain is great enough to enable A.V.C. to be used, and this in turn enables a large, and almost constant, signal, irrespective of frequency, to be applied to the detector, thus reducing detector distortion very considerably.

Two Remaining Types

Only two types of wide-band tuner remain to be described. They both provide better answers than any of the others, when properly designed and built, but one of them is quite beyond the scope of anyone but an engineer to design, and of anyone but a broadcasting service to afford! The latter is a special kind of receiver that is more closely allied to the T.R.F. than anything else. It contains amplifiers working directly at the signal frequency, and both its band-pass qualities and its selectivity towards adjacent channels are obtained by the use of very complex band-pass filters, each using several inductances which must be very carefully designed and adjusted. This sort of receiver is essentially a single-frequency device, because, once designed and built, it is quite impossible to shift its frequency except by re-designing the filter circuits and adjusting them in the laboratory. In short, it has to be designed only for the frequency on which it is to be used, and one would need five separate receivers to get one's five local stations. All the disadvantages of signal-frequency amplification can be overcome by this very complex and very expensive means, but such a receiver is economical only for such highly specialized purposes as monitoring in broadcast stations and for receiving another station for re-broadcast purposes.

The remaining receiver type, which we have purposely left to the last, is the synchrodyne, which is really the answer to almost every question. It works on an entirely different principle from any other receiver, and actually manages to break the ancient deadlock between bandwidth and selectivity. It can be given an effective selectivity curve that is actually the ideal for which we have been striving. Its distortion is immeasurably small, and there is no restriction at all on its bandwidth. It is the only type of receiver, apart from the filter type described above, which can provide a frequency response at the output that is as good as, or even better than, the response achieved by the transmitter. It has one disadvantage—namely, that its construction requires a great deal more care and precision than any of the conventional kinds of receiver. There is no doubt, however, that it is worth the extra time and trouble. Also, numerous synchrodynes have been built from detailed designs published in this journal, with every success, by amateur constructors. There will, of course, have been failures, too, but these do not constitute a criticism of the worth of the type of receiver, since sufficient care in construction is all that is needed for 100 per cent. success, as many will testify. It is not proposed even to disuss the principle of the synchrodyne here, because this has already been done,

(Concluded on page 51)

New Tubes and Transistors

A NEW SERIES FOR CAR RADIOS

While there is no doubt that, sooner or later, car radios will become completely transistorized, we are at the moment in the somewhat awkward situation that only a very few types of transistor are available that are suitable for R.F. amplification on the broadcast band. A notable exception, however, is the R.C.A. 2N247, samples of which have recently become available, and which is capable of high stage gain on the broadcast band without neutralization. In the meantime, Philips, who have available transistors suitable for I.F. amplification and for B/C band frequency conversion, but who have not yet announced a transistor for R.F. amplification at these frequencies, have come up with a very interesting alternative to transistors for use in car radios and other equipment which must be run from 12 or 6-volt accumulators.

This takes the form of a special series of valves, designed to work satisfactorily from H.T. voltages as low as 6.3 volts.

H.T. Equals 12 or 6 Volts!

The idea behind the new series is that these valves should be used in the R.F. and I.F. circuits of car radios, together with a transistorized A..F amplifier section. This enables a car set to be run directly from the car's battery, without any special source of H.T., such as the conventional vibrator supply or motor-generator. In this way, a car set avoids the difficulties associated at the moment with complete transistorization, and yet achieves the main advantage of using transistors throughout. It is certainly quite an achievement to have produced a series of valves which will function satisfactorily with H.T. as low as 6 volts, but this is successfully accomplished in the new series. First of all, there is the ECH83, and oscillator-mixer. Then there are two H.F. pentodes. The EF97 is a variable-mu pentode suitable for R.F. and I.F. amplification, and also for use as a mixer, with separate oscillator valve. The EF98 is for I.F. and audio applications. Finally, there is the EBF83, a duo-diode-pentode. The pentode section is variable-mu, so that it can be used either as an I.F. or an A.F. amplifier, with the diodes used in the ordinary way as detector and A.V.C. rectifier.

Characteristics

The full characteristics are given in the accompanying reproductions of the manufacturer's data sheets for the EBF83. It will be noticed that the mutual conduct-

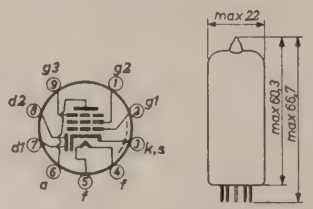
DOUBLE DIODE-PENTODE with variable mutual conductance for use as I.F. amplifier, detector and for A.G.C. in carradio sets to operate directly from a 6 V and 12 V storage battery

Heating : indirect. Parallel supply or two tubes in series on 12 V battery

V_f = 6,3 V

I_f = 300 mA

Dimensions in mm



Base, culot, Sockel: NOVAL

Capacitances	Pentode section		Diode section	
	C_a =	5,2 pF	C_{d1} =	2,5 pF
	C_{g1} =	5,0 pF	C_{d2} =	2,5 pF
	C_{ag1} <	0,0025 pF	C_{d1d2} <	0,25 pF

Between pentode and diode section

C_{d1g1}	<	0,0008 pF
C_{d2g1}	<	0,001 pF
C_{d1a}	<	0,15 pF
C_{d2a}	<	0,025 pF

Operating characteristics as I.F. amplifier

V_a	=	12,6	6,3 V
V_{g3}	=	0	0 V
V_{g2}	=	12,6	6,3 V
V_{g1}	=	[1])	[1]) V
I_a	=	0,45	0,12 mA
I_{g2}	=	0,14	0,04 mA
S	=	1,0	0,45 mA/V
R_1	=	1,0	0,65 MΩ

Limiting values

Pentode section

V_a	= max.	30 V
V_{g2}	= max.	30 V
I_k	= max.	5 mA
R_{g1}	= max.	5 MΩ
V_{kf}	= max.	30 V

Diode section

I_{d1}	= max.	0,8 mA
I_{d2}	= max.	0,8 mA
I_{d1_p}	= max.	5 mA
I_{d2_p}	= max.	5 mA

[1])Obtained by grid current biasing; R_{g1} = 2.2 MΩ

ance at a plate voltage of 12.6 is 1.0 ma/volt, and for a plate voltage of 6.3 it is 0.45 ma/volt. When it is remembered that ordinary valves like the EF39 have mutual conductances of the order of 2.0 to 2.5 ma/volt with an H.T. voltage of 250, it will be realized that the new valves must be of radically new design, such as to give a much higher Gm at low plate voltages than conventional tubes would have at the same voltages. Indeed, the EF98 has the astonishing Gm of 3 ma/volt at 12.6 volts H.T., and 1.8 ma/volt at 6.3 volts H.T.

Other Applications

Although the new series has been designed especially for car radios, it is clear that there will be many other applications in which their special characteristics will make them useful. Any receiver, for example, that must work from a very low H.T. voltage will be able to use them, and obtain the inestimable advantage of using the heater supply as the H.T. supply at the same time.

The heaters of the new tubes are for 6.3-volt operation only, so that for 12.6-volt working, a series-parallel connection of the heaters will be necessary. It should be noted, too, that the maximum H.T. voltage is 30 volts, so that care must be taken not to plug them into sockets in conventional equipment where the H.T. voltage is much higher.

Another possible application, provided that suitable precautions are taken against over-voltage, is their use in sets intended to work from 30-volt farm lighting systems. The valves also open up possible applications for valves in entirely new applications that could not be practicable otherwise. Completely unattended receivers, or other equipment, can be run without the use of relatively inefficient vibrators for H.T. supply.

MISSING AND STOLEN RADIOS

Auckland

H.M.V., 5-valve broadcast, encased in brown plastic case, about 12 in x 10 in. x 8 in. Model 525 B.C. serial No. 24888. Three years old and identifiable. Value £14.

Pye, Model R, serial No. 41633. Cabinet painted royal blue, speaker panel light blue, 5-valve broadcast, radiogram, three-speed player.

Pye, Model PZ26BQ, portable battery, covered in blue rexine, plastic handle, two control knobs, one each end. Centre knob for stations; stations marked in circle in middle of plastic dial. Size, 8 in. high, 5 in. wide, 11 in. long. Four rubber domes on base. "Pye" written on brass plate on right-hand corner. Serial No. 84225; identifiable. Value £16 17s. 6d.

Philips Vistagram mantel model radiogram, 5 valve, cream and maroon plastic cabinet with clear plastic top, three-speed single player. Serial No. 79028. Licence No. 139082. Identifiable and valued at £28 10s.

Philips car radio, Model 656, 4 valve, steel-grey unit with chrome front, speaker in separate attachable unit. Adaptable 6 or 12 volt. Serial No. 3602. Licence No. 183963. Identifiable and valued at £19 10s.

Philips Model A.G. 1000; three speed, fully automatic, fawn and cream plastic finish, no serial number. Valued at £12 10s.

Philips radio, Model 256M, serial No. 90077, brown plastic case; valued at £17 17s.

Skyscraper radio, 6 valve, broadcast model. Ply varnish cabinet, size 24 in. x 12 in. x 12 in., 4 tuning knobs on front of cabinet; back of cabinet missing. Serial No. 124432. Valued at £36.

Autocrat car radio, eight valves, push-button control. Painted black, silver facings, gold dial. Serial No. 31042. Identifiable; valued at £45.

Ultimate portable radio, A.C. and D.C. Grey-mottle in colour, white handle, round dial. Serial No. 122182. Valued at £35 and identifiable.

Motor Rollo, car radio; six volts; painted grey. Serial No. not known. Valued at about £5.

Christchurch

Clipper radio, white plastic case, good order; 5-valve broadcast; valued at £12.

Philips Model 146, about 10 in. x 6 in. x 5 in., in mahogany coloured plastic case; dial 4 in. x 1 in.; two control knobs.

H.M.V. portable radio, battery-electric; maroon case with white surround on dial and white knobs. Serial No. 51950. Valued at £20.

Philco dual-wave small radio, white plastic case. Serial No. 69890; valued at £13 10s.

Westco car radio, 7 valves, measuring 12 in. x 6 in. Painted dark brown with a white dial measuring 4 in. x 2 in. Two brown tuning knobs on either end of the radio. Valued at £20.

Hamilton

Clipper Model 4P6. Serial No. 88203. Plastic cabinet, size 9½ in. x 6½ in. x 2¾ in. Encased in grained leather carrying case, fitted with dome fasteners and shoulder strap.

Hawera

Mullard 4-valve model, brown coloured case, Serial No. 12549. In new condition; valued at £17 10s. and identifiable.

Lower Hutt

Chevrolet 12-volt car radio, push-button and rollers, tone control and either 8 or 5 volt. Identifiable and valued at £30.

Pacemaker portable radio, maroon colour, the dial of which folds out from the top and is ivory colour. The back of the radio has a piece broken out of it measuring about 1¾ in. x 4 in. The front also has a piece missing, at the base in the corner, about 2 in. x 1½ in. The radio is about six months old and identifiable. Valued at £37 17s. 6d.

New Plymouth

Pacemaker portable, purchased in 1949, 6 valves, mottled red canvas cover over case, approximately 18 in. long by 12 in. high. Plastic front cream coloured, one of speaker bars broken on front. In good condition; valued at £34 7s. 6d. Serial No. 67473/27852.

Normanby

H.M.V. 5-valve broadcast set, York model (47-52). Wooden cabinet about 10 in. high, 15 in. wide and 8 in. deep, in medium stain varnish. Dial on top of set and half-round in shape; 5 glass valves (6X5, 6V6, 6Q7, 6U7, and 6K8). Serial No. unknown. Valued at £14 and identifiable.

(Concluded on page 50)

ELECTRICAL AND TRADE SECTION

STANDARD FOR ELECTRICALLY HEATED BLANKETS

EDITOR'S NOTE.—*At the time of writing, we are aware of only one make of electric blanket that is currently available on the New Zealand market that meets the very stringent specification of B.S.S. 2612.*

The Minister of Industries and Commerce, the Hon. E. H. Halstead, anounced recently that a revised British standard for electricall-heated blankets, suitably amended to meet New Zealand conditions, had been adopted as a New Zealand standard specification.

The purpose of the standard, said the Minister, was to establish requirements relating to the electrical and mechanical construction of electrically-heated blankets that would ensure safe, efficient, and durable service. A British standard was first issued in 1955, but as a result of experience gained from its use, the specification was extensively revised last year. This revision was examined by the responsible committee of the Standards Institute, which recommended its adoption, in amended form to suit local conditions, as a New Zealand standard.

Compared with the original standard the most important features of the revised edition, the Minister said, were concerned with strengthening the standard's safety provisions. For instance, a new flammability test had been incorporated to ensure that the materials used in blankets would not ignite, and the use of highly inflammable materials such as kapok was not permitted. Also, changes had been made to guard against the possibility of flame-proofing agents damaging the electrical components. A further modification was designed to reduce the possibility of electric blankets causing radio interference.

Many English authorities were responsible for the formation of the Standard, representing professional, technical, manufacturing, power supply, safety and consumer interests. This meant that the wide experience of all these interests, as well as the knowledge of our own professional and technical people, was made available to the people of New Zealand through the provisions of this standard.

"Of course," the Minister added, "the prevention of accidents depends not only upon the adequacy of the materials and workmanship used in the manufacture of electric blankets, but also upon their proper use. With the object of avoiding their abuse therefore the standard requires that advice relating to the proper use of electric blankets shall be supplied with each one sold. For example, these instructions warn against the hazards involved in switching on the current if a blanket is damp, in sleeping with a blanket switched on, or if one is left switched on when covering an unattended baby or a helpeless person."

In conclusion, the Minister said he would like to express appreciation of the ready co-operation of manufacturers and other trading interests in connection with the adaptation of this standard to our needs. He hoped, and indeed, was confident, that this attitude would ensure the general use of the Standard Mark on electric blankets. This safeguard would be appreciated by the people purchasing these modern and efficient bed-warming aids, an assistance to consumers which the Government was endeavouring to extend in as many directions as possible.

The Minister-in-Charge of the State Hydro-electric Department, the Hon. W. S. Goosman, commented that if the purchaser of an electric blanket or heating pad were to insist on the article complying with a recognised Standard Specification, such as the new N.Z.S.S. 1302 or the British Specification B.S.S. 2612 for blankets and N.Z.S.S. 1124 or B.S.S. 1789 for heating pads, the purchaser would obtain an article that should be safe to use.

The Minister said that it was fortunate indeed that more serious accidents had not resulted from the use of blankets and pads. With 155 fires reported by the Insurance Offices and Electric Supply Authorities in the past 21 months since reports were asked for, the user of an electric blanket or heating pad would be well advised to follow the makers' instructions and have the article overhauled by a qualified person at regular intervals, say every two years.

The Standard Specifications now available provide the purchaser with a measure to determine quality. The specifications provide the manufacturer with minimum requirements for a safe and efficient article.

Along with the adoption of the New Zealand Specification for electric blankets, arrangements have been made for the provision of testing facilities so that New Zealand manufacturers and importers can readily obtain the information required to show that their blankets or pads comply with the appropriate specification. With the assistance of the State Hydro-electric Department, the Industrial Development Department of Canterbury University College is equipped with pad testing equipment and will be equipped for electric blanket tests by the end of February.

Mr Goosman concluded by saying that the electrical industry provides safe equipment and seeks the co-operation of the user in keeping electricity safe. In the case of electric blankets and pads it is sound advice to buy only those articles that comply with a recognised specification, to use them carefully and in strict accordance with the makers' instructions and to have them overhauled at regular intervals,

THE UNITED KINGDOM'S RADIO EXPORTS

The following communication from the British Radio Industry Council gives some very interesting figures on the industry's export business during 1956, *and some advance information on the* 1957 *National Radio Show, to take place at Earls Court in August-September.*

From all the indications received it appears likely that the value of direct exports by the Industry during the past year will have reached £40,000,000. At the time this letter is written the foregoing can only be a forecast, but it is based on the solid achievement of £36.8M worth of exports during the first eleven months of 1956. If we reach the £40M mark the increase over the 1955 figure will be no less than 21%.

One of the most gratifying features of our 1956 radio export performance was the mounting sales to dollar markets. For the first six months of the year the United States was our best customer, taking no less than 8.1% by value of our overseas sales. At the end of the first nine months of the year America had dropped back a little to share with Australia the distinction of being our best client. Both countries had, in the period, imported 7½% of our radio exports—over £2M worth going to each of them.

You may find of interest a breakdown into groups of radio exports given below and scaled up from 11 months' actual performance to indicate what the year's total might be:

	£M
Domestic receivers	3.86
Sound Reproducing Equipment	7.57
Components and test gear	8.45
Valves and tubes	3.51
Transmitters, radar and similar "capital" goods	16.81
Total	£40.2M

The point to note here is that whilst exports of domestic receivers are subject to increasing sales resistance — even the Egyptians propose to "roll their own"—our overseas sales continue to mount of the types of radio goods that are not so easily made by tyros. Of course, the countries which assemble their own receivers have to get their component parts from some reliable source—which goes some way to explain the rising exports of British components *and* sound reproducing equipment.

A wide selection of British radio and television receivers, components, valves and sound reproducing equipment will be seen at the National Radio Show, to be held in Earls Court, London, from 27th August to 7th September this year.

In general, radio "capital goods" do not lend themselves to showing at these events: nevertheless, a fine display is expected of this type of equipment on stands manned by the Armed Forces, in the R.I.C. Control Room and elsewhere in the Exhibition.

Foreign nationals and Britons resident overseas are admitted gratis to the Radio Show.

Astronomical Television Equipment Used on the Largest Telescope in the Southern Hemisphere

The Pye television camera designed to aid the special observation of Mars during its recent "close approach" to the earth was transferred to The Radcliffe Observatory, Pretoria, from Bloemfontein, South Africa, where it had been used by the National Geographical Society's Mars expedition. The Radcliffe Observatory which was transferred in 1948 from Oxford, where it had been established for more than 150 years, now possesses a 74-inch reflecting telescope which is the largest in the Southern Hemisphere.

Television tests were carried out on this instrument and discussed with leading astronomers as part of the investigations which have been going on in Cambridge since 1951 on the possibilities of producing an electron telescope. It is hoped that with the aid of electronics, astronomers will be able to penetrate further into space in the course of their observations on distant galaxies, and also gain more knowledge of the planets in our own solar system.

In practice the Pye television equipment operates in conjunction with any large refracting or reflecting telescope. The object of the equipment is to detect a greater amount of the light which has been collected by either the lens or mirror of the telescope.

During the observance of Mars at the Lamont-Hussey Observatory, Bloemfontein, Mr B. V. Somes-Charlton of Pye Ltd., obtained over 1500 television photographs which have been taken to America for examination by Dr E. C. Slipher, a leading authority on the planet.

BACK NUMBERS OF "R. & E. R."

Back numbers are available from

S.O.S. Radio Ltd., 283 Queen Street, Auckland.
S.O.S. Radio Ltd., 1 Ward Street, Hamilton.
Webb's Radios Ltd., 11 Wellesley Street E., Auckland.
Tricity House Ltd., 209 Manchester Street, Christchurch.
Ken's Ltd., 142–144 Stuart Street, Dunedin.
Fear's Radio & Cycle Co. Ltd., 31 Willis St., Wellington.
The Radio Service Co., 83 Guyton Street, Wanganui.
Technical Book and Magazine Co., 295–299 Swanson Street, Melbourne, Australia.

NEW PRODUCTS: LATEST RELEASES IN ELECTRICAL AND ELECTRONIC EQUIPMENT

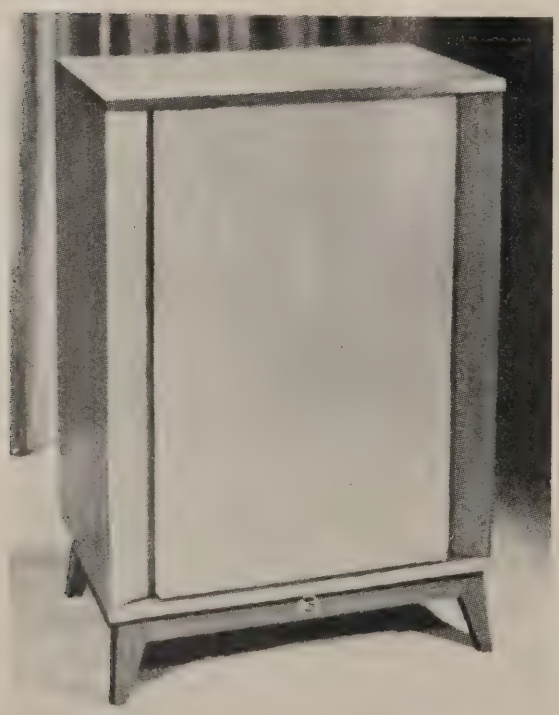
This section of our paper is reserved for the introduction of new products and space preference is given to our regular advertisers. For further particulars contact Advertising Manager, R. & E., Box 8022, Wellington.

R.C.A. Completes Range of Hi-Fi Equipment

Deservedly popular on the New Zealand high-fidelity market are the R.C.A. Orthoponic amplifier and control unit. This amplifier comes into the highest possible quality-bracket, and enthusiasts and dealers will be pleased to see that R.C.A. Great Britain Ltd., who are represented in this country by Amalgamated Wireless (Australasia) Ltd., Anvil House, Wakefield Street, Wellington, have recently completed a full range of reproducing equipment with the issue of the Orthoponic variable-reluctance pick-up, a high-class transcription turntable, and an excellent loudspeaker system. The complete system provided by this collection of units has been designed for musical reproduction of the best possible quality, and should be as widely accepted by connoisseurs as the amplifier and control unit have been. Further details are given below.

* * *

A New Speaker System



The R.C.A. New Orthoponic High-Fidelity Loudspeaker System comprises a 15 in. bass reproducer, with two w½ in. tweeters, positioned for wide-angle high-frequency distribution, mounted in a specially designed bass-reflex type of cabinet. Thus, the purchaser is assured of the best results without having to have a suitable baffle designed and constructed for him. The response of the system is from 29 c/sec. to 20,000 c/sec. The cross-over is at 2,000 c/sec., and the impedance of the system is 15 ohms, making it suitable for connection to most commercial high-quality amplifiers as well as for the R.C.A. amplifier. The damping of the cabinet is carefully arranged for best transient response and freedom from "overhang" effects.

An unusual feature of the cabinet is its separate mounting plinth, which enables it to be mounted either vertically or horizontally, with or without the Swedish-type legs. This gives the cabinet four possible configurations, one of which will suit any furniture style or room lay-out. It can be obtained either in light oak or in piano-finished walnut.

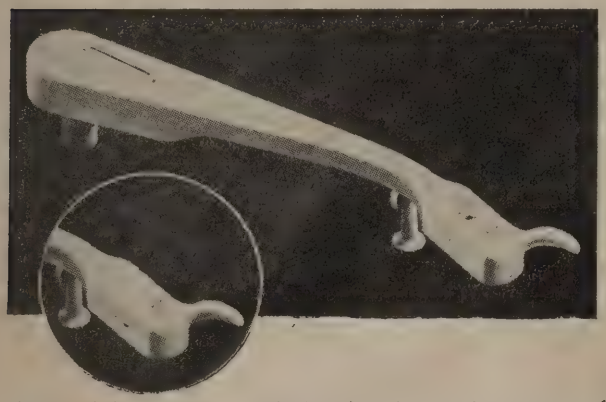
* * *

Transcription Unit

The R.C.A. transcription turntable unit is a single record player incorporating the R.C.A. variable-reluctance pick-up, and an excellent heavy-duty motor and turntable. An entirely new type of speed-change mechanism has been designed to give absolutely uniform turntable speed, whilst improved technique in the construction and assembly of the motor ensures reproduction free from rumble and frequency modulation. The drive from a stepped pulley on the motor spindle is transmitted to the rim of a deep and heavy turntable through a single heavy moulded rubber idler wheel, which runs in a long self-oiling bearing of small diameter, giving maximum lateral stability with minimum frictional drag. The speed change control knob has a very light movement and operates a unique cam action which retracts the idler wheel to a position clear of both the turntable and the motor pulley while changing its height to engage one or other of the steps of the motor pulley. In this way, all possibility of damage is avoided should the speed change control be operated while the machine is running. The idler wheel mounting brackets and the speed change mechanism are built as a rigid unit integral with the motor suspension frame.

The turntable is a carefully balanced non-magnetic casting weighing approximately 8½ pounds and fitted with a rubber turntable mat. Most of the weight is near the edge, giving the greatest possible flywheel effect. The main bearing is approximately 3 in. long, and the weight of the table is taken by a steel ball pressed into the lower end of the bearing. Because of the unsatisfactory nature of most automatic stop mechanisms, no such stop is fitted to this unit.

The R.C.A. 8-Pole Balanced Variable Reluctance Pick-up



These pick-ups are available in alternative arms, the longer of which enables 16 in. records to be played. They can be fitted with either a single or a dual-stylus cartridge. The dual version is pivoted so that moving a lever on top of the pick-up head from one side to the other brings either the 78 or the L/P stylus into operation. This model has provision for altering the stylus weight to suit the stylus in use. A sliding weight is accommodated towards the back of the arm, and can be moved in a slot so that the weight is increased for 78 r.p.m. records and reduced for L/P.

The pick-up has high sensitivity, negligible hum, pick-up, and an exceptionally smooth and extended frequency response, together with negligible distortion.

Either a stylus or a cartridge can be changed very easily, the former without removing the cartridge. This can be carried out successfully by the owner.

The cartridge is hermetically sealed in a manner which protects it not only from dust and damp, but also from mechanical shock.

There is no difficulty in using the pick-up with any turntable, as it is provided with an adjustable pedestal which enables the height above the motor board to be altered to suit the turntable.

Specification

D.C. resistance: 350 ohms.

Impedance at 1,000 c/sec.: 530 ohms.

Capacitance: Less than 50 $\mu\mu$f.

Tracking pressure: (a) Microgroove, 5 to 7 gm.; (b) 78 r.p.m., 9 to 12 gm.

Frequency response: Flat, from 20 to 16,000 c/sec. within $\pm$ 2 db. Single stylus response rises gradually to 20,000 c/sec. without resonance.

Lateral compliance: 5×10^{-6} cms/dyne.

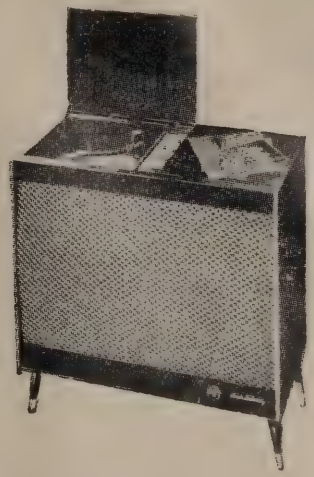
Equivalent stylus mass: 4.5 milligrams dual and 3.5 mg. single stylus.

Input Impedance: The pick-up will give optimum results working into impedances between 10k. and 100k. ohms. Higher values of input impedance are acceptable provided that the lead to the amplifier is of reasonable length and low capacity.

Output: The sensitivity is such that up to 100 millivolts is given by 45 and 33 r.p.m. records, and up to about twice this figure by 78 r.p.m. discs. Thus, virtually all high-fidelity amplifiers can be fully loaded without the use of a step-up transformer.

* * *

The R.C.A. "President" High-fidelity Gramophone



Almost as if in answer to "R. & E.'s" editorial last month, comes the announcement by Messrs. Amalgamated Wireless (Australasia) Ltd. of the "President" —a packaged high-quality electric gramophone. This outfit contains no radio tuner, and is designed solely for playing gramophone records. Built into the attractive cabinet is a speaker system comprising a 12 in. woofer and two 4 in. tweeters, in an acoustically designed infinite baffle.

The "works" include a 10-watt push-pull amplifier incorporating negative feedback, independent bass and treble lift and cut controls, 4-speed automatic changer with facilities for manual or automatic playing, and a high-fidelity crystal pick-up. The cabinet design is attractive, and can be had in light oak or in walnut finish. It is not too large for small rooms, measuring 33 in. wide, 16½ in. deep, and 26 in. high, plus 7 in. for the attractively turned legs.

This instrument represents really high reproduction quality at a very reasonable price, and as such is a leader in the high-fidelity field.

CHANGE OF ADDRESS

When you change your address, be sure to notify the Subscription Department, "Radio and Electrical Review", P.O. Box 6361, Wellington New Zealand, and do this at least four weeks in advance. To avoid disappointment through not receiving your copy of "Radio and Electrical Review", should it go to the wrong address through your failure to notify us of a change, we earnestly ask for your co-operation in this important matter.

AIR-GROUND LINK FOR PRIVATE AIRLINES

By Maria Boldini, B.A., Dip.Ed.

Editor's Note

This article illustrates very well the great importance of the electronics industry to the safety and convenience of air travel, and how a well-set-up and lively radio industry can very quickly fulfil new communication requirements as the need for them arises.

The electronic industry penetrates into every nook and cranny of our lives, from an action as simple as listening to the radio to involved and impressive equipment for television, radar and space rockets. One branch of the electronics industry has kept pace so well with aeronautical engineering that the Americans have coined a word for it—AVIONICS.

Electronic equipment carried by planes is all directed towards creating greater safety in air travel. It would be useless to engineer even larger, higher and faster flying planes unless these planes are equipped with devices to safeguard the lives of passengers and crews.

Besides many electronic devices which perform calculations humanly impossible under flying conditions, planes are taking aloft more and more safety devices, specially radar. Such devices must be reliable and lightweight. This is not an easy combination to achieve.

Australia is one of the most air-minded nations in the world. We have no option of course with the distances between our own cities and towns so great and our distance from other countries also so great Australia's air safety record is one of the best in the world. Australian aircraft have always carried equipment for communication with ground stations, maintained by the Department of Civil Aviation, for air traffic control. They also carry many radio navigation aids including a Radio Compass and a Range Receiver for "flying the beam". Lately Amalgamated Wireless (Australasia) Limited has helped to develop a radar device known as Distance Measuring Equipment (DME) and has supplied equipments to all Australian airlines. This device enables a pilot to locate his distance from ground beacons set up at fixed places, and, in conjunction with other navigation aids, tells him exactly where he is. The Department of Civil Aviation has made it compulsory for passenger aeroplanes to install this equipment.

East-West Airlines found themselves faced with problems in the North-Eastern section of N.S.W. where planes serve the towns of Armidale, Tamworth, Glen Innes, Inverell and Gunnedah. Although the D.C.A. communication system caters adequately for the safety of aircraft and for weather reports and the like, it does not cater for private communication between the airline offices and company aeroplanes. Moreover, D.C.A. ground stations are located only at main aerodromes, and are not available at most of the country aerodromes served by E.W.A. E.W.A. decided to overcome these problems by installing ground to air "Private Line" communication in their planes and at these country aerodromes as well as in their main aerodromes in N.S.W. As A.W.A. handles all aircraft and radio servicing for this airline, East-West approached A.W.A. on the project of designing and developing a lightweight very high-frequency transceiver for their planes and a ttransmitting and receiving ground station for the aerodromes concerned. A.W.A. has succeded in this task, and the first ground stations have been completed at Inverell, one at the aerodrome and one at the airline's agency. The small aerial from which messages are transmitted and recorded is erected on a mast about 30 feet high either at the aerodrome or the Agency office. A transmission line connects the aerial to the transceiver—so called because it both transmits and receives. This transceiver has modulating equipment and a special power unit. In this way voices can be sent directly through the air from plane to ground station or vice versa. The equipment has a range of 100 miles and as it operates on a frequency of 125 mc/s. is free from static interference. People in the waiting room at the aerodrome have already been startled to hear a pilot voice's voice coming in over the loudspeakers.

In Sydney we have already learned how greatly the radio-telephone increases the efficiency of our taxi services. What can East-West expect of it in their planes?

The pilot, let us imagine, is supposed to land at Inverell but for some reason—weather probably—cannot make it. He can advise both the Agency office and the aerodrome at Inverell that he cannot land. The staffs at Inverell will be saved a great deal of unnecessary worry and confusion. Relatives and friends can be advised that the plane is safe and landing at Armodale or Glen Innes whatever the pilot thinks best. Passengers wishing to pick the plane up at Inverell could travel across country and pick it up at another aerodrome with a minimum of delay. Trucks and buses could be held in readiness to transport any urgent passengers and freight from the emergency landing point to Inverell. Very little imagination is needed to conjure up a host of details contributing to general discomfort and confusion which could be eliminated or minimised by the installation of this new trans-

ceiver. For example, the aerodrome may wish to advise the pilot not to land but to proceed without wasting time to another landing ground. When all these country towns are linked in this way, the aerodrome chosen for the emergency landing can also be advised and swing into action ahead of the actual time of landing to deal with this extra task. The inhabitants of Glen Innes especially hope for a great deal from this new device. Despite all the efforts of East-West in the past, plane services to this town have been unreliable.

Even if changes of plans and delays do not occur, the pilot of a plane equipped with air to ground communication can advise the aerodrome of his exact landing time, freight and passenger lists, petrol requirements and any other pertinent details. The aerodrome can be so well organised that the plane's standing time there can be appreciably diminished. All this tends towards greater efficiency in the general running of the airline.

The new device, it is hoped, will cope with irritating delays and unavoidable changes of plans as well as increase general efficiency and safety.

TV ROUND THE GLOBE

(Concluded from page 47)

Band I and Band III, enabling them to get the commercial stations as well.

* * *

Two Years of Eurovision

In the two years over which programme exchanges over the "Eurovision" long-distance links have been in progress, a total of 289 programmes have been exchanged. Of these, the Western Germany system has originated the largest number—namely, 45. Second equal come the B.B.C. and the T.R.F. (French television system), with 39 programmes each. All told, twelve TV broadcasting authorities took part in the exchanges, all except one of them originating some of the programmes.

HALF-YEARLY IMPORT FIGURES

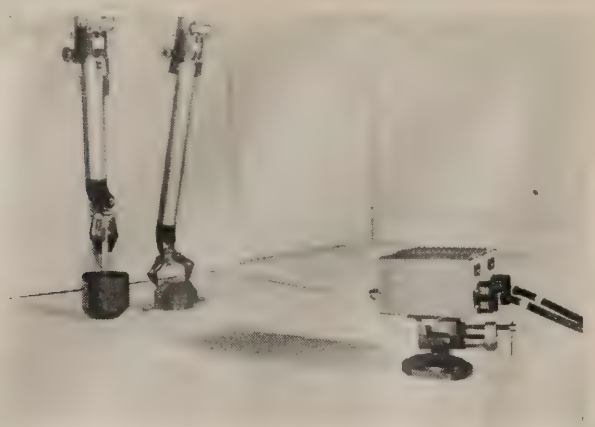
Six Months Ended 30th June, 1956

Item and Country of Origin	Number	£(N.Z.)
Transformers for receiving sets (72101.17)		
United Kingdom	8,135	1,448
Australia	6	51
Netherlands	30	30
U.S.A.	2	10
Denmark	392	21
Total	8,565	1,610
Valves for receiving sets (72104.1)		
United Kingdom	116,487	31,146
Canada	—	33
Australia	40,278	11,234
Germany-Federal Republic	54	32
Italy	750	133
Netherlands	199,054	37,456
U.S.A.	47,448	10,330
Total	404,071	90,364
Valves for transmitting sets (72104.2)		
United Kingdom	2,116	7,768
Australia	5	27
Netherlands	645	668
Switzerland	50	214
U.S.A.	10	327
Total	2,826	9,004
Receiving sets, built up but not mounted in cabinets (72104.6)		
United Kingdom	25	1,172
Receiving sets mounted in cabinets (72104.7)		
United Kingdom	241	4,229
Australia	12	215
Germany-Federal Republic	2	25
Netherlands	7	38
Japan	3	11
U.S.A.	1	21
Total	266	4,539
Transmitting apparatus—other than valves (72104.8)		
United Kingdom		25,844
Australia		14,186
Germany-Federal Republic		50
Netherlands		2,104
U.S.A.		414
Sweden		195
Switzerland		106
Total		42,899
Other Wireless Apparatus (72104.13)		
United Kingdom		155,133
Australia		31,896
Denmark		902
France		1,639
Germany-Western Zone		5,837
Italy		328

LATEST OVERSEAS DEVELOPMENTS

Stereoscopic Television for Harwell

A stereoscopic television camera unit which has been designed specifically for use in nuclear research is shortly to be supplied by Marconi's Wireless Telegraph Company Ltd. to the Atomic Energy Authority's research station at Harwell.



Showing the stereoscopic camera set up to observe the "mechanical hands" which are handling radioactive material in an entirely enclosed space.

The equipment will be used with special remote manipulating equipment for the handling at a distance of dangerous radioactive materials. Special equipments are at present under development, some of which will be capable of remote manipulation up to distances of half a mile (or more if desired).

It is obvious that some form of visual aid is necessary for operations of this kind. Ordinary closed-circuit television has already been tried, but has proved to have limitations, in so far as the absence of perspective in the screened image makes it difficult for the operator to judge the distance of the manipulator's "hands" from the objects to be handled. With the stereoscopic television now developed by Marconi's, perspective has been restored, and the operator sees what appears to be a solid (i.e., three-dimensional) image.

One of the types of manipulator which will be used with the stereoscopic unit is that manufactured by Messrs. Savage & Parsons Ltd., of Watford, to the specifications of the Atomic Energy Authority. The combined equipment was demonstrated at Watford on 28th February and 1st March.

This type of manipulator, which is capable of operating through a biological shield up to 6 ft. thick, is controlled by clips attached to the operator's fingers. The movements of the fingers are transmitted through a system of extension rods terminating in a mechanical hand, which reproduces the hand and finger movements of the operator. Sufficient control over the mechanical hand is obtained to enable such operations as removing the stopper from a bottle and pouring the contents into a beaker to be effected without difficulty, provided, of course, that the operator can see the objects to be manipulated.

The Marconi stereoscopic camera channel consists of two industrial Vidicon cameras, two control units, and two display monitors. The cameras are mounted side by side, with their lines of sight inclined so that they intercept at the "point of interest."

The left-hand camera of the pair (corresponding to the left eye) is connected to one of the monitors, which thus gives a left-eye view of the scene; similarly, the right-hand camera and monitor give a right-eye view.

The two monitors are positioned in the display cabinet in such a way that the pictures are superimposed by means of a semi-silvered mirror. A vertically polarized polaroid filter covers the face of one screen, while the other is covered by a second polaroid filter which is horizontally polarized. If the composite image is viewed through suitably polarized spectacles, a stereoscopic effect is obtained.

* * *

"Diamond Pivots" Now Included in Self-checking Laboratory Instruments

A new development has just been announced by the Sensitive Research Instruments Corporation. "Diamond Pivots" and calibrated-spring, shock-mounted sapphire jewels are now included in the complete line of Laboratory Standard A.C./D.C. self-checking instruments. This new feature is available also as optional equipment for other Sensitive Research instruments.

When installed in an instrument, these two components will take the tremendous impact of a three-foot drop on to a concrete floor without deformation. This means a virtually friction-free moving element in any electrical indicating instrument under the severest conditions of abuse—where such friction may be due to deformation of either pivot or jewel. Diamond pivots are ground to a riding surface of 0.008 in. They

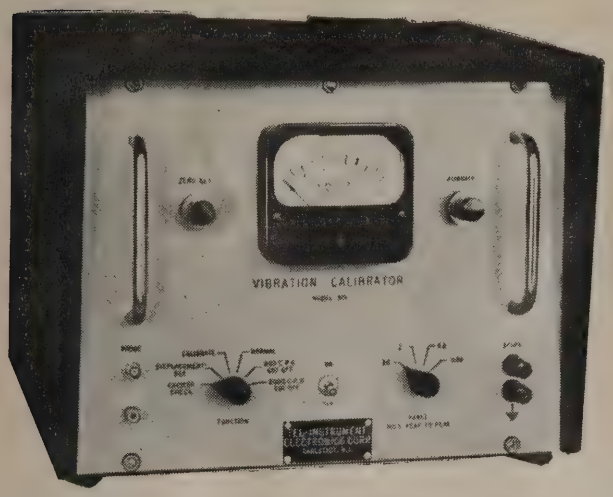
are completely non-magnetic and exhibit no hysteresis effect in an instrument.

They are economical to install when considered against the cost of repair and maintenance.

Complete details and specifications are available from Ad. Auriema Inc., Technical Products Division, 89 Broad Street, New York 4, N.Y.

* * *

Unique Vibration Calibrator Available from Tel-Instrument



The Vibration Calibrator Model 501, originally designed for the U.S. Armed Forces is now available to industry and research laboratories all over the world.

This unit, designed to calibrate vibration pick-ups of non-metallic surfaces, has a vibration amplitude range of 0.00002, 0.0002, 0.002, and 0.020 inch (0.0005, 0.005, 0.05, and 0.5 mm.) at frequencies from 10 to 20,000 cycles per second. The accuracy rating is 5 per cent. The same accuracy is obtainable even when measuring vibrations of non-sinusoidal nature. Besides allowing direct meter reading of vibration displacement in thousands of an inch, voltage terminals are provided to permit observation of vibration waveform with a conventional oscilloscope.

Applications of this instrument cover a wide variety of fields, from automative to aircraft, home appliances to instrument manufacturers, testing laboratories, universities, and others interested in vibration measurement problems.

Details are available from Tel-Instrument Export Division, 89 Broad Street, New York 4, N.Y.

* * *

New Plessey Turret Terminal

A new type of rolled turret terminal, which combines similar efficiency with lower cost when compared with conventional types made from solid materials, is now being manufactured by the Plessey Company Limited.

The design of this new terminal represents a considerable advance on previous types, as a series of serrations has been added to the under-side of the flange, thus preventing the terminal from rotating when overheated or when knocked.

Designed to meet the requirements of the Joint Services Radio Component Specification, these Plessey turret lugs are made from brass to B.S.267 and are silver-plated.

Terminals of this type are particularly useful in that they can be applied to tag-boards and terminal strips made to manufacturers' individual requirements.

They are available in two sizes as follows:

X.T.1 with a base diameter of 0.078 in., for use where maximum wire size for centre hole is no greater than 0.028 in. diameter (22 s.w.g.).

X.T.2 with a base diameter of 0.100 in., for use where maximum wire size for centre hole is no greater than 0.048 in. diameter (18 s.w.g.).

New Sealed Panel Lampholder for Electronic Equipment

A new sealed lampholder, the X.L.2, which is particularly compact and robust, has just been introduced by the Plessey Company Limited. Designed for use in field communications equipment, it is suitable for industrial and military electronic equipment operating under conditions where moisture, dust, or corrosion are encountered.

The X.L.2 will accommodate midget flange lamps and can be provided with a plain cap or, alternatively, a dimmer cap with a full range of adjustment. Both caps are available in red, green, or amber.

The brass body of this lampholder is lined with a phenolic bush and is provided with flats which prevent rotation when the unit is mounted in a panel. Spring-tempered beryllium copper contacts, which pass through the bush and into ceramic-to-metal terminal seals in the end of the body, ensure a perfect hermetic seal which is unaffected by high temperatures and remains unbroken when the cap is removed for lamp replacement.

The dimmer cap, moulded in alkyd material, is sealed with a synthetic rubber ring, compressed between cap and the rotating shutter body, and this ring also facilitates smooth and reliable action of the shutter.

The plain cap is fitted wih a concentric metal sleeve which centralizes the lamp. Raised concentric ribs on the inside of the cap moulding give an indication when the lamp is in the "ON" position during conditions of strong direct sunlight.

Plessey type X.L.2 lampholders (Pat. App. for No. 18190/55) are suitable for use in the temperature range —40° C. to +100° C. and have been designed to R.C.S. (Prov.) 201. Following comprehensive testing to this specification, they have been granted R.C.S.C. Quality Type Approval.

EICOnomise - Buy EICO INSTRUMENT KITSETS

WELLINGTON BRANCH OF N.Z. ELECTRONICS INSTITUTE (Inc.)

TELEVISION PROJECT

Readers who have been interested in the television project which has been under way for a considerable time now will be pleased to learn that the transmitter will be on the air very shortly, and that test signals may have been radiated by the time this appears in print.

Transmission Frequency

It had been hoped to make the initial transmissions on B.B.C. Channel I (sound carrier 41.5 and vision carrier 45 mc/sec.), but for reasons outside the Institute's control this is no longer possible, and transmissions will take place on the experimental TV band covering approximately 94 mc/sec. to 99.95 mc/sec. The terms of the Institute's experimental licence state that the sound carrier shall be at 99.90 mc/sec. and that the vision carrier can be anywhere lower in frequency, provided that no radiation extends below 94.0 mc/sec. This restricts the choice of vision carrier frequency to quite narrow limits. In order to make the transmitted signal as much like the standard British TV signal as possible, it would be desirable to put the vision carrier at 96.40 mc/sec., which would make it 3.5 mc/sec. lower than the sound carrier frequency. The condition that no radiation shall extend below 94 mc/sec. means that either the modulation bandwidth must be restricted to 2.4 mc/sec., or else vestigial-sideband transmission must be used. While the latter would be the best solution, it is likely that, initially, restriction of the bandwidth will be used until such time as it is possible to design and build a vestigial-sideband filter, which in itself is quite a big job of work.

Trasmission Standards

Transmission will be according to the British 405-line standard, with 2:1 interlacing, 4:3 aspect ratio, positive modulation, and A.M. sound. Unfortunately, it will not be possible to use existing British TV receivers without modification, since they do not cover the frequency band that has to be used. Also, the experimental transmission has the carriers the wrong way round, in that the British receivers are designed on the assumption that the sound carrier is 3.5 mc/sec. lower than the vision carrier—not higher, as the experimental transmissions will have to be. Fortunately, however, both these difficulties can be overcome by the use of a simple converter ahead of the receiver, if it is already built for 45 mc/sec. By placing the oscillator of the converter on the low side of the signal frequencies—i.e., at 58.4 mc/sec., the sound carrier can be heterodyned to 41.5 and the vision carrier to 45.0 mc/sec. simultaneously, thus effecting conversion and transposition at the same time. Thus, the full details of the transmisions will be as follows:

Sound carrier	99.90 mc/sec.
Vision carrier	96.40 mc/sec.
Modulation polarity	Positive
Sound modulation	A.M.
Aspect ratio	4:3
Lines per picture	405
Lines per frame	202½
Synchronizing waveform	As per B.B.C.
Synch.-to-video ratio	3:7
Aerial type	Turnstile
Polarization	Horizontal
Aerial power (estimated)	7½ watts E.R.P.

The date of commencement of transmissions is not yet known, but it is hoped that initial aerial tests will be carried out within three or four weeks of publication of these notes.

Transmitted Material

The terms of all experimental licences expressly forbid the transmission of anything approaching a programme of entertainment value; this rule will not affect the project's transmissions, as these will be designed to be of interest to technically interested people only. Initially, no equipment will be available for transmitting live scenes, so that the first pictures will consist only of geometrical patterns and of the B.B.C. Test Card C, which is available from a monoscope camera. Shortly after the commencement of transmissions, however, it is hoped to have both a flying-spot scanner, for showing transparencies, and a camera, for live scenes, both on the air. The sound channel will be used for transmitting spoken information on the vision signals being transmitted. This will enable additional information to be given, which will tell viewers whether their receiving apparatus is performing properly in all respects. It will be possible, therefore, to indicate whether faults at present in the transmission which might wrongly be attributed to the receiving equipment, and to give a large amount of data on the exact nature of the pictures being transmitted.

TV ROUND THE GLOBE

Eire and New Zealand

There was once a book written on the flora and fauna of Ireland, and in the chapter headings was to be seen one entitled "Snakes." On turning up this chapter, it was found to consist of one sentence only: "There are no snakes in Ireland."

The fact that there is no television there either, should make further explanations of our first sub-title in this month's "TV Round the Globe" superfluous.

* * *

TV Stations Throughout the World

As at 1st July last year, the following television stations were in operation throughout the world:

Argentine	1	Korea	1
Belgium	4	Luxembourg	1
Brazil	6	Mexico	9
Bulgaria	1	Monaco	1
Canada	35	Netherlands	2
Colombia	3	Nicaragua	1
Cuba	10	Norway	1
Czechoslovakia	2	Philippines	1
Denmark	3	Poland	1
Dominica	1	Rumania	1
Finland	1	Saar	1
France	13	Spain	1
Germany (East)	9	Sweden	3
Germany (West)	31	Switzerland	4
Great Britain	17	Thailand	2
Guatemala	2	Turkey	1
Hungary	1	Uruguay	1
Iraq	1	U.S.S.R.	25
Italy	24	Venezuela	4
Japan	7	Yugoslavia	2

These total 235 stations, but do not count the U.S.A., which has 499, counting territories and the U.S. armed forces. The grand total of stations throughout the world is therefore 734, 499 of which are in the United States.

Of those countries which have TV stations, only eight have 10 or more, while 14 have four or more stations. Eighteen of the forty-one countries listed had only one station at the time of the survey, but in several cases these single stations represent the first of a projected chain of stations. Australia does not appear in the list, as it was compiled before the Australian stations had opened.

* * *

Australia

In December of last year, the Division of Secondary Industry, a Commonwealth Government department, issued a half-yearly report on television, based largely on opinions expressed by various sections of the industry itself.

From the report, it appears that by October, 1956, 23 manufacturers had started, or were about to start, production of television receivers. Of these, 17 had previously been established as manufacturers of radio receivers only, and of the remainder, four had been operating in other branches of the electrical and electronics industry.

The production of TV sets up to the end of October, 1956, totalled 25,250, and imports 1850. The production was estimated to be 50,000 sets by the end of the year. Of the latter number, about three-quarters were estimated to be equipped with 17 in screens. The production capacity for 1957, based on the industry's plans, may possibly even exceed 300,000. It is anticipated that by the end of this year manufacturers of picture tubes should be in a position to meet the total Australian requirements for cathode ray tubes.

* * *

Automation in TV Studios

The N.B.C., in America, is planning to apply automation to their television studios in New York. The idea is to have cameras, floodlights, microphones, and even scenery, movable by remote control from the control room rather than to have men in the studio actually moving these items about. Not only this, but it is planned to have whole sequences of operations controlled by a tape record which is made during rehearsals, and which, once fed into the control mechanism, performs the whole sequence of operations according to the predetermined plan, with unfailing timing accuracy. No doubt, too, arrangements will be made so that the producer can manually interrupt the automatic sequence, should necessity arise.

* * *

Commercial TV in Britain

According to our contemporary *Wireless and Electrical Trader*, published in London,, the influence of commercial television on the number of TV licences is difficult to assess. The *Trader* says that the programme companies' claim to have been directly responsible for a large proportion of the increase since commercial TV started does not seem to stand up under close examination.

During the 12 months from 30th September, 1955, to the same date in 1956, TV licences increased from 4,884,000 to 6,140,000—an increase of 26 per cent. In the "competitive" areas, in which the B.B.C. and the I.T.A. are both operating, the increase was only 19 per cent.

Although, on the whole, sales of receivers were higher in 1956 than in 1955, this did not affect the number of licences very much because of the large proportion of replacement sales. It has been estimated that about half the sales in the commercial TV areas have been replacement sales, in which people with old Band 1 sets (which would receive only the B.B.C. transmissions) replaced them with sets receiving both

(Concluded on page 43)

JOHN GRAY'S RECORD PAGE

I always thought a meringue was an afternoon tea delicacy, and a difficult thing to manoeuvre at that; it turns out that the word also applies to a Haitian dance (also sometimes spelt "merengue"), appearing on record labels. Whether the meringue will prove, in a popular way, the successor to the rapidly subsiding samba and mambo it is perhaps a little early to predict, but W and G are off to a flying start with a 12-inch LP called "Original Meringues," performed by Emy de Pradines with the Haiti Dance Orchestra and chorus (WG PMR 163). Miss de Pradines has lived all her life in Haiti and is an expert on these dance forms; she was starred in the "Voodoo" LP recently emanating from the same source (WG PMR 149).

POP. GASTRONOMY

John Gray

Festival have re-issued the record "This is High Fidelity," on Vox DL 130. It has already been in heavy demand as a demonstration disc and will be further sought by the addicts of sound reproduction pure and simple, but the ordinary music lover will probably reflect that its cost, four guineas, is almost that of two top-grade long-playing records of straightout music. The recording is not "unique," as the sponsors state, for Capitol have also produced one, and no doubt other companies will follow suit. Other Festival releases are fewer these days, but notable amid recent ones is a long-playing "Great Songs from Great Shows," done with taste and style by Frank Barclay's piano and rhythm (FR 10-1127), and a collection of Hawaiian songs sung by none other than Bing Crosby will not be without its appeal, the more so as he is backed by the orchestras of Lani and Dick McIntire (FR 12-1169).

DEMONSTRATION DE LUXE

The Pye-Mercury people are now in full production. On the popular side they are rightly concentrating on their own top rock and roll group, the Platters, with three single-disc releases. M 4203 contains "You'll Never Know" and "It Isn't Right," and there are revivals of "The Great Pretender" on M 4220 and "The Magic Touch" on M 4221, all on 78, by the way. Mercury's version of "Stranded in the Jungle" is by the Gadabouts, and it shares M 4218 with "Blues Train." In the long-playing supplement there is a very tasteful piano recital played by Constance Keene; it comprises Bach's fifth French Suite, Beethoven's Variations in C Minor, and the Brahms Variations on a theme by Paganini—a well-arranged group (MG 10138), while the last-named composer is further represented by a refined performance of his fourth symphony by the Detroit Symphony Orchestra under the veteran French maestro, Paul Paray (MG 50057). Two of Mozart's finest string quartets, the E Flat and "Hunting" quartet in B flat, both from the six he dedicated to Haydn, are played by the Roth String Quartet, a group absent from local record lists for many years, on MG 10109. They reappear on MG 10134 with two of the last quartets, the B flat and F major from Mozart's "King of Prussia" series.

ON YOUR PLATE

Fred Astaire is the latest big name to join the Verve label, and his offerings on V 5009, with backing from Buddy Bregman, are "There's No Time Like the Present" and "Hello, Baby." The versatile Bregman also directs the accompaniment for Ella Fitzgerald's latest coupling, "A Beautiful Friendship" and "Stay There," on V 5012. Jerry Lewis, now striking out on his own, is announced as another recruit to the Verve label.

SWERVE AND VERVE

With the return of Gilbert and Sullivan to our stages, many will want records of the music from these enduring works, only to find that, apart from the various "complete" recordings, there is not much else available at present. However, W & G announce a 12-inch LP (PMC 248) of instrumental highlights from "HMS Pinafore". This will be ideal, in the manner of the Kostelanetz "Opera for Orchestra" series, for those who crave the music but couldn't care less about the words, though some may consider the price rather high for what is, after all, only a glorified "selection", even though it is announced as being played by the Philharmonia Orchestra.

A NEW G. & S. DISC

RCA have produced a new Eddie Fisher record, a bright coupling of "Oh My Maria" and "Sweet Heartaches" (10208). People say Mr Fisher has no voice and can't sing, but I get more pleasure out of his vocalising than I do out of several others who make a much bigger noise. Other 45s on this label include Mario Lanza's "Someday" and "Sylvia" (16040), and Italian vocalist Nilla Pizzi in "Arrividerci Roma" and "Amapola" on 10147. There should be a welcome for the latest Sauter-Finegan disc, "Pale Moon" and "Of Thee I Sing" (10191) and among Westerns, Stuart Hamblen's "Ole Pappy Time" stands out as a catchy and melodious number. It is backed, on 10085, by "The Toy Violin".

HE'S VOCAL

Capitol revive a good old Joe "Fingers" Car disc with "Put Another Roll on the Player Piano" and "Mr and Mrs Cocynut" (2883), and there is also Nat "King" Cole's "Night Lights" and "To the Ends of the Earth" (3551). But their fastest selling number of late has undoubtedly been 2558, the first record by yet another rock and roll group, Gene Vincent and his Blue Caps. "Who Slapped John" and "Bluejean Bop" are as uninhibited as anything ever put forth by Haley or Boyd Bennett, and maybe the sooner we have a surfeit of this kind of thing the sooner its devotees will work it out of their systems. Meanwhile they will jump for joy at the news of a Capitol LP by Gene Vincent (T764) which contains the above mentioned masterpieces and ten others as well. A good corrective to all this is perhaps contained in the release of two parodies by one Terry Thomas and his Rock and Roll Rotters, who mount a full-scale assault on "Lay Down Your Arms" and "A Sweet Old Fashioned Boy", on Decca DEC 108. For the rest, there are four versions of the newly popular "Autumn Concerto", of which you may care to try the one by Ambrose and his Orchestra (MGM73009); there is Winifred Atwell's latest party record (DEC107) and Pat Boone's newest, which is a coupling of "Tennessee Saturday Night" and "Ain't That a Shame" (London HL8172).

THUMBS UP

"R. & E.'s" HIT PARADE LIST

We are indebted to the publishers of "Musical Express" for the lists below, which we hope will be of considerable assistance to dealers as a guide for their "pop" record buying.—Ed.

WEEK ENDING 16th FEBRUARY

	Title	Artist	Position last week	Record Make
1	Young Love	Tab Hunter	1	London
2	Don't Forbid Me	Pat Boone	2	London
3	Knee Deep in the Blues	Guy Mitchell	3	Philips
4	Long Tall Sally	Little Richard	4	London
5	Don't You Rock Me, Daddy-O	Lonnie Donegan	8	Pye-Nixa
6	Banana Boat	Harry Belafonte	6	H.M.V.
7	True Love	Bing Crosby and Grace Kelly	12	Capitol
8	Singing the Blues	Guy Mitchell	5	Philips
9	Banana Boat Song	Shirley Bassey	9	Philips
10	Friendly Persuasion	Pat Boone	10	London
11	Garden of Eden	Frankie Vaughan	7	Philips
12	Adoration Waltz	David Whitfield	13	Decca
13	The Girl Cant Help It	Little Richard	—	London
14	You Don't Owe Me a Thing	Johnnie Ray	20	Philips
15	Wisdom of a Fool	Norman Wisdom	—	Columbia
16	Banana Boat Song	The Tarriers	15	Columbia
17	Don't Knock the Rock	Bill Haley	11	Brunswick
18	She's Got It	Little Richard	—	London
19	Blueberry Hill	Fats Domino	16	London
20	Look Forward, Angel	Johnnie Ray	—	Philips

CLASSICAL CORNER

Columbia's "La Traviata" (33CX 1370-1) scores over its rivals in that the opera—complete, that is, save for the traditional cuts—is contained on only two discs. Once again this is a La Scala production, under the knowing direction of Tullio Serafin, and the protagonist is the young Antonietta Stella, who is perhaps being pushed into leading roles, on records at least, before she is quite ready for them. Possibly some of her unevenness can be blamed on Verdi himself, for writing the first act for a coloratura soprano and the other two for a lyric-dramatic. In his day, singers were trained to cope with such a wide range of style, now hardly any of them can manage the coloratura. One can't have everything! Guiseppe di Stefano is the lover and Tito Gobbi brings his usual authority to bear on the role of the father. Speaking of authority and moving to a different sphere, we need look no further than Benno Moiseivitsch for a completely satisfying account of Rachmaninoff's phenomenally popular Rhapsody on a theme of Paganini (HMV CLP1072). Moiseivitsch studied this work with the composer himself and was one of the first pianists to take it up after Rachmaninoff had given the premiere in 1934, in fact Moiseivitsch was for a long time the only other pianist to make a recording of it. That old edition has now given way to this new performance with the Philharmonia Orchestra under Hugo Rignold, and as the veteran pianist seems to have retained all his old dexterity, it is a record to be seriously considered, and the reverse is given over to some first-class Chopin solos, including the magnificent "Barcarolle".

An orchestral disc of rare distinction and largely unhackneyed material is contained on Columbia 33 SX 1048, whereon half a dozen Waldteufel waltzes are played by the Philharmonic Promenade Orchestra under Henry Krips, a brother of Joseph Krips, and well known as conductor of one of Australia's regional orchestras. You should enjoy this excellently played collection of "The Skaters," "Pomona," "Grenadiers," and others by this minor but decidedly gifted "waltz king." Another in the light orchestral series offers a convenient coupling of both of Grieg's "Peer Gynt" suites as played by the London Symphony Orchestra under George Weldon. People in the record trade tell me the familiar old "Peer Gynt" music is as strong a seller as ever, and so here is an inexpensive LP version of these evergreen pieces. There is a third orchestral disc which should be in demand, the more so in this year of Elgar's centenary: on HMV ALP 1379, Sir Adrian Boult conducts all five of the "Pomp and Circumstance" marches, adding for good measure the lesser known but enjoyable overture "Froissart," a piece best described in Elgar's own sub-title, "When Chivalry Lifted up Her Lance on High."

Collectors of instrumental pieces are well catered for in the latest lists. Malcuzynski's admirers, for instance, have a recital disc (Columbia 33 MCX 1344), which contains, in addition to Debussy's "Submerged Cathedral" and some familiar Rachmaninoff and Chopin, less hackneyed but very worth-while pieces by Szymanowski and Scriabin. A new young Russian pianist, Eugene Malinin, makes a definite impression with his disc of Beethoven's "Waldstein" sonata in C major. This record endeavours to give us the best of both worlds, for it is rounded off by a sonata and a "Sarcasm" by Prokofieff and two poems by Scriabin (33 CX 1343). Walter Gieseking, a great pianist of the older

(Concluded at foot of next page)

generation, whose death towards the end of last year was one of the more melancholy happenings of a year which had its full share of sorrow for musicians as well as for the rest of the world, had been engaged on a complete recording of Beethoven's sonatas almost up to the very day of his death. I understand that about two-thirds of them had been completed and will in due course be published. Meanwhile, we have 33 CX 1374, which gives us two of the greatest of the later sonatas, the E major and A flat major, opus 109 and opus 110 respectively. Finally, we note another new pianor ecord, in the plum label HMV category (CLP 1071), which introduces a new name, Edith Fisher. Her choice of material is refreshingly new also, for the collection of Studies, opus 104, by Mendelssohn does not seem to have been available previously, and we have not been overburdened with versions of Schumann's "Davidsbundler" dances, which occupy the reverse side of this attractive release.

SOME SPEECH

Among LP "revivals" it is pleasant to note that Sir Laurence Olivier's well-made records from the sound tracks of "Hamlet" and "Henry V" have been expertly transferred to one record (HMV ALP 1375). They previously occupied three and four 12-inch 78s, and so the re-issue offers welcome value, and each side contains a generous proportion of the incidental music written by Sir William Walton. There is further Shakespeare on a Columbia record, which by coincidence bears the same number—33 CX 1375. On one side Dame Edith Evans delivers a group of the sonnets, and on the other she reassumes her famous role of Rosalind in "As You Like It" in a traversal of some of the most brilliant episodes from that play, in which she is joined by Michael Redgrave, Ursula Jeans, and other stars.

MORE OPERA

Decca has Sir Arthur Bliss conducting his brilliant and really colourful "Colour Symphony" (LXT5170) and many people will eagerly investigate LXT5136, a collection of operatic choruses sung by the famed chorus of the Rome Santa Cecilia Academy. Many of these have been "lifted" from Decca's complete opera sets, but two new offerings are the famous choruses from Verdi's early operas, "Lombardi" and "Nabucco". The latter, which is the famous "Chorus of the Hebrew Slaves", is one of those inspired, devastatingly simple tunes of which Verdi alone seemed to possess the secret, and is perhaps the most gripping item on this very well made recording. In addition Decca have recoupled their existing sets of "Cavalleria Rusticana" and "Pagliacci" so that they occupy only three disc between them, and the numbers of this re-issue are LXT 5223-5. Previously each opera was available on three sides, with a Mario del Monaco recital on the fourth. Another operatic release which could be easily overlooked in the welter of present-day issues is on a Parlophone extended play 45, MGEP 22. It contains four popular arias recorded in pre-war days by the very gifted tenor Joseph Schmidt. The excerpts are from Puccini's "La Boheme", Leoncavallo's "Pagliacci", and the famous "O Paradiso" from Meyerbeer's "L'Africana". On a more homely level is the newest John Charles Thomas LP. HMV have collected, on to MBLP6003, his famous "Open Road", and "Love Can be Dreamed", as well as half a dozen others sung in his well remembered manner.

RADIO CLASSES

For Operators, Engineers. Servicemen, commence on 1st February, 1957. Enrolments received now.

NEW ZEALAND RADIO COLLEGE
26 HELLABY'S BUILDING, AUCKLAND, C.1.

MISSING AND STOLEN RADIOS

(Concluded from page 37)

Taupo

Columbus 5-valve mantel model, clock, and radio combined. The clock is embedded in face of radio above dial. There is a white knob at either end of the dial, brown bakelite case, model No. 563, serial No. 52572. Valued at £28 10s. and identifiable.

Tokoroa

Autocrat 5-valve car radio, brown case, oblong dial, two white tuning knobs; serial No. 27240; valued at £27.

Wanganui

Two Clipper car radios, models cr55, serial Nos. 74905 and 74954.

Clipper 8-valve car radio, model cr.8U5, serial No. 76869; painted a shiny maroon colour, centre piece missing from one of the control knobs.

Wellington

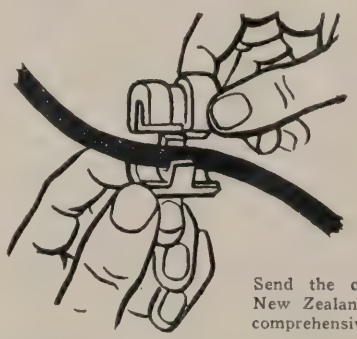
Pacemaker, battery-electric, cream bakelite case, 15 in. x 8 in. x 8 in., serial No. 30678.

Philco, battery-electric, 5 valve, cream bakelite case, 12 in. x 10 in. x 8 in., serial No. W20629 61404.

RADIOS RECOVERED

Palmerston North: Bell radio, serial No. 6536.
Rotorua: Ultimate, 5-valve radio, serial No. 80557.
Wellington: Pye portable radiogram, dark blue case, with dark brown interior and burn mark on right front of lid.

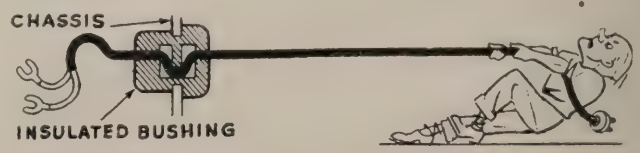
Give your wiring a non-slip grip where it's weakest



Nylon Strain Relief Bushings absorb cord pull and offer a positive insulating grip without 'nipping'. Easily applied, you just place the bushing on the wire and push into the hole.

Besides securely anchoring the cord to the appliance I.M. Nylon Strain Relief Bushings look neat and smart.

Send the coupon below to the exclusive New Zealand Distributors for samples and comprehensive literature.



Electra Mechanics Limited,
8 Lunn Avenue, Auckland, E.2.

Please send me samples and literature of The Nylon Strain Relief Bushings.

NAME

ADDRESS

HIGH-QUALITY RECEIVERS

(Concluded from page 35)

but for those who want to know just how good broadcast quality can be there is no other type to build. There are certain other limitations that are not altogether chargeable to the synchrodyne as such, and one that is. It is not feasible to build a continuously tunable one, and this is a limitation that *is* inherent in the principle. Similarly, it is not possible to apply A.V.C., but this is of little practical importance, because the special type of detector used by the synchrodyne does not, like the conventional diode detector, depend for lack of distortion on the presence of a large signal amplitude. Like most high-quality tuners, the synchrodyne is also limited to regions of fairly great signal-strength, although where the signal is weak, but reasonably free from deep fading, it can be used quite well. In this respect it has an advantage over most other systems.

When there's a better switch
ARCOLECTRIC will make it
New Zealand Agents
GREEN & COOPER LTD. WELLINGTON.

FRED ROTHSCHILD AND SON

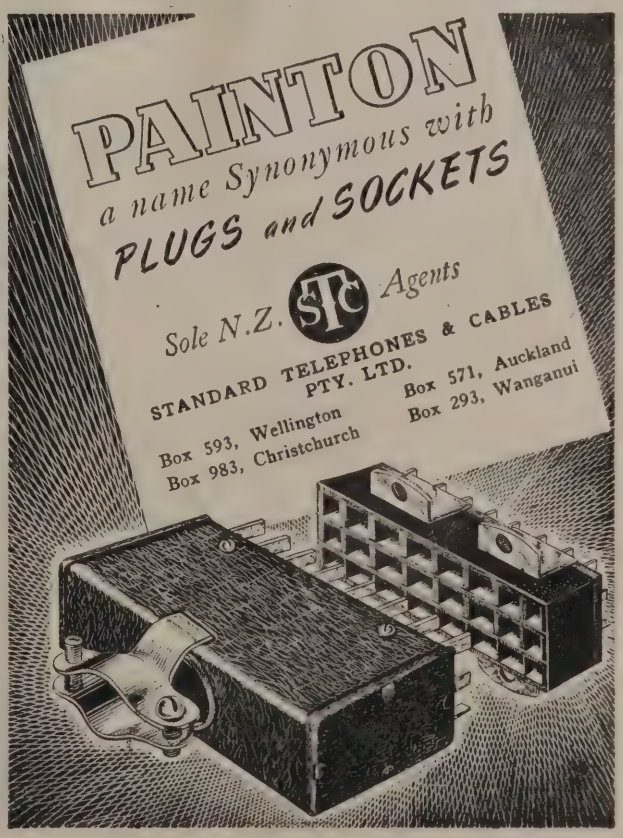
wish to advise that, as from 1*st April*, 1957, *this firm will be known and will trade as*

P. H. ROTHSCHILD & CO. LTD.

83 PRETORIA STREET, LOWER HUTT
P.O. Box 170

Our new phone number is 63-591, but messages may be left at 61-698.

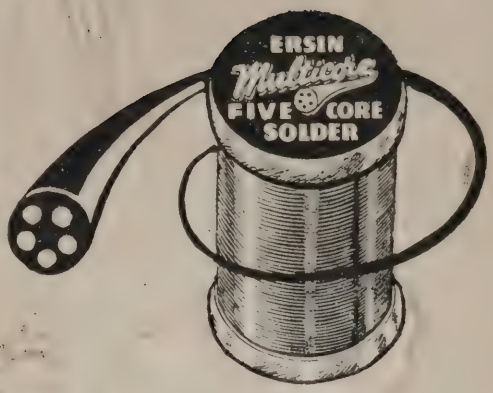
The staff is the same as before, and we assure you of our usual courteous service and attention at all times.



ERSIN

Multicore

SOLDER



"... the finest cored solder in the world"

Available ex-stock in a range of sizes and alloys to meet all requirements

GE2.6

New Zealand Distributors: GILES & ELLIOTT LTD. Wellington, Auckland, Christchurch, Dunedin.
Also available from all branches of Turnbull & Jones Ltd.

SPEED and PRECISION

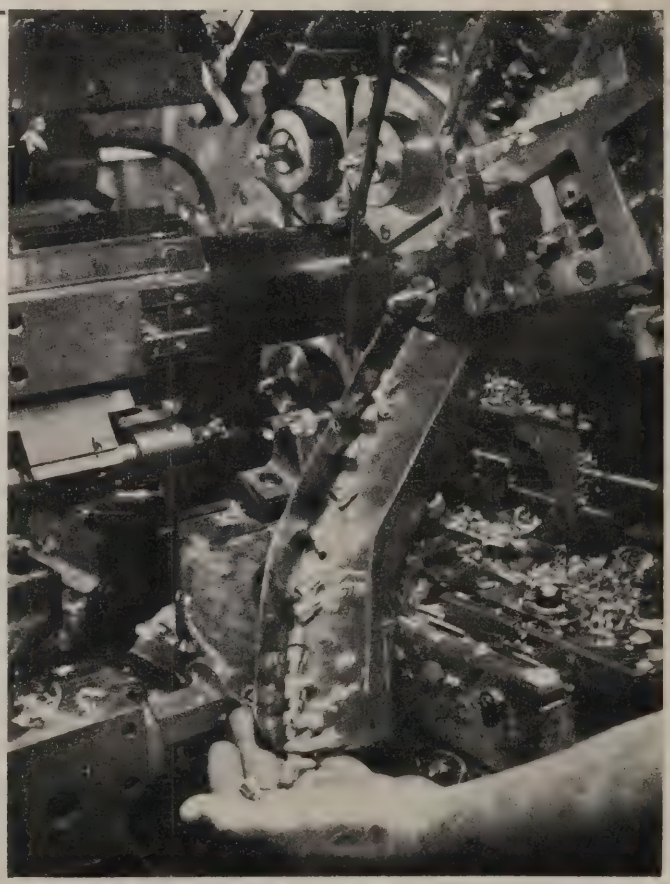
TWO OF THE VITAL FACTORS IN THE MANUFACTURE OF COMPONENT PARTS! And two of the basic reasons why every day more and more manufacturers throughout New Zealand turn to us to supply their factories with parts.

We have the modern machinery to mass-produce any part which can be made from stock up to 2¼ inches in diameter . . . we have the skilled technicians to guarantee perfect uniformity and accuracy . . . PLUS the organization behind both men and machinery to ensure that your order is fulfilled to your entire satisfaction and ON TIME.

IF YOUR PROBLEM IS COMPONENT PARTS, YOUR SOLUTION IS . . .

AUTO MACHINE MANUFACTURING CO. LTD.

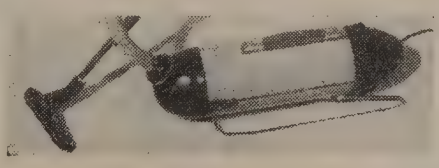
18-20 NELSON STREET, AUCKLAND, C.1
P.O. BOX 179. TELEPHONE 31-638



You'll be happy with a G.E.C.

"You'll be happy with a G.E.C." That is the slogan in our advertisements to the public, your customers. Indeed, your customer will be happy with a G.E.C. vacuum cleaner. Remember these facts that SELL *G.E.C. cleaners:*

Powerful suction for perfect cleaning. Easy to manoeuvre. Resiliently mounted motor. Light, sturdy, beautifully designed. Easy to keep clean. Double insulated for maximum safety. Fitted with radio interference suppressor.



G.E.C.

BRITISH GENERAL ELECTRIC CO. LTD.

NEW ZEALAND SUBSIDIARY OF THE GENERAL ELECTRIC CO. LTD. OF ENGLAND

Wellington, Auckland, Hamilton, Napier, Christchurch, Dunedin, Invercargill.

Quality and Craftsmanship

are typical features of every product made in the great ULTIMATE-EKCO Plant

Only the best of materials, the best of workmanship, goes into every Ultimate-Ekco product. Even the tiniest screws used in Ultimate-Ekco radios are treated as if they were jewels and meticulously chromium plated to ensure absolute trouble-free performance. Finest quality brass and copper are used in Ultimate Electric Jugs and Toasters, and the same insistence on quality in design as well, is the foundation stone upon which Ultimate-Ekco leadership has been built.

Here are Radio and Electrical products you can SELL with Confidence !

ULTIMATE-EKCO (N.Z.) Co. Ltd.

QUAY STREET —— AUCKLAND

PERSONALITY PARADE

World's Largest Radio and TV Dealer Visits New Zealand

It is not very often that multi-millionaires visit this country, and it is even more unusual for them to be retailers of radio sets. Among the first to agree would probably be our own radio dealers, few of whom look like entering that class, but nevertheless such a man exists, and has recently been engaged on a six-week tour of New Zealand. He is Mr J. James, who, with Mrs James, has been here in the course of a world tour of Commonwealth countries.

A few weeks ago this journal had the pleasure of meeting Mr and Mrs James at an informal cocktail party given for them at the St. George Hotel, in Wellington, by Mr Leighton Lord, Chairman of Directors of Philips Electrical Industries of New Zealand Ltd., and found him one of the most interesting men associated with our industry whom it would be possible to meet.

He is a young man to have amassed such a fortune, and, believe it or not, he has done so between 1946 (when, like many of us, he came out of the R.A.F.) and the present time. Starting with some £30,000 of capital, he opened his first shop in Bristol, his home town, and within twelve months he had six shops in the same city. As can be imagined, such rapid expansion had to be financed out of profits. This was done, in the face of incredulous remarks from his competitors in Bristol, who stated categorically that a chain of more than six shops in a city of that size would not pay dividends. After watching carefully the returns from the seventh shop (which showed that the competitors' theory was groundless), Mr James decided that the sky was the limit, and he now has twelve shops in Bristol alone. His first venture out of this town was to open in Bath, which is very small by comparison, and where he now has three shops. Expansion followed into other centres, and finally to London itself, where the James organization now has more than a hundred shops.

All this sounds very much like a fairy story, but it is hard fact, to the extent that the organization consisted (at the time of talking to Mr James) of some 250 shops throughout the British Isles.

It is a long time now since the total turnover reached £1,000,000, and it is now many times that figure per annum.

How Is It Done?

Well, our own impression of how all this has been built up in so short a time is that, basically, it is due to Mr James's refusal to have any fixed ideas on what can or cannot be done. He is already the largest dealer in the field, not only in Britain, but in the world, and his ultimate aim is to have 1,000 shops in Britain by 1960 to 1962, and to have a quarter of the total turnover in radio and television sets in the country. And, having met the gentleman concerned, we would not mind laying a few bets that he does both.

In addition, Mr James has some novel ideas about selling. He spends nothing at all on advertising, holding the view that his shop managers must be able to sell their goods without this aid. Consequently the utmost reliance is placed on the attractiveness of the shop premises and on the selling ability of the salesmen manning the shop.

Radio and TV Only

A feature that is unusual to our eyes is that the shops of Mr James's chain sell nothing but radio and television receivers, hi-fi equipment, and records. No electrical appliances of any sort. He says that effort put into selling appliances, which are in general of much smaller unit value than radio and TV receivers, is wasted if the same time can be put into selling the latter, with their higher unit value, and therefore higher return per sale.

Emphasis on Service

Mr James was most emphatic on the importance of selling service as well as sets. In fact, he maintains a 24-hour repair service on television receivers. To do this, his shops employ one serviceman for every salesman, and it pays. Many of the points made by Mr James seem to conflict directly with retailers' policy in this country, which makes us wonder whether some of our retailers are not on the wrong tack. It is true that conditions in the United Kingdom are different from those obtaining here. For one thing, we have no television, and Mr James states quite emphatically that, until television comes, the radio dealer does not know what business is like! However, some of his policy planks would be well worth study by his New Zealand opposite numbers, for no one can say that he has not achieved success!

Pye Director Visits New Zealand

A recent visitor to these shores was Mr J. O. Stanley, a director of the Pye group of companies, and the son of Mr C. O. Stanley, the Chairman of Directors of Pye. Members of the radio trade had the opportunity of meeting Mr Stanley at a cocktail party given in his honour in Wellington in the new offices of the Pye group in Tory Street, and found him a most enthusiastic believer in all things electronic, and in television in particular. In a short speech, after which he declared the new premises officially "open," Mr Stanley said that we "really ought to have television here." He thought that the lack of public demand would right itself in time, through the proximity of TV in Australia, and that those of us who are keen on its introduction should carry out as much propaganda activity as possible in an attempt to make the average man realize what he was missing in not having it. "It won't do much good if you just talk television among yourselves. What you need to do is to talk about it to those who haven't really thought about it, one way or the other, and keep on talking until you get something done about it."

EICOnomise - Buy EICO INSTRUMENT KITSETS

Plessey

RADIO COMPONENTS

Variable Capacitors, Air and Compression Trimmers, Drives and Couplings, Vibrators, Chokes and Transformers, I. F. Transformers, Wavechange and Toggle Switches, Valve Holders and Pilot Lamp-holders, Loudspeakers, Iron Dust Cores and Formers, Potentiometers, Cascap and Caslam Capacitors, Electrolytic Capacitors.

New Zealand Representative:

WILLIAM J. BLACKWELL

P.O. BOX 1622 :: AUCKLAND

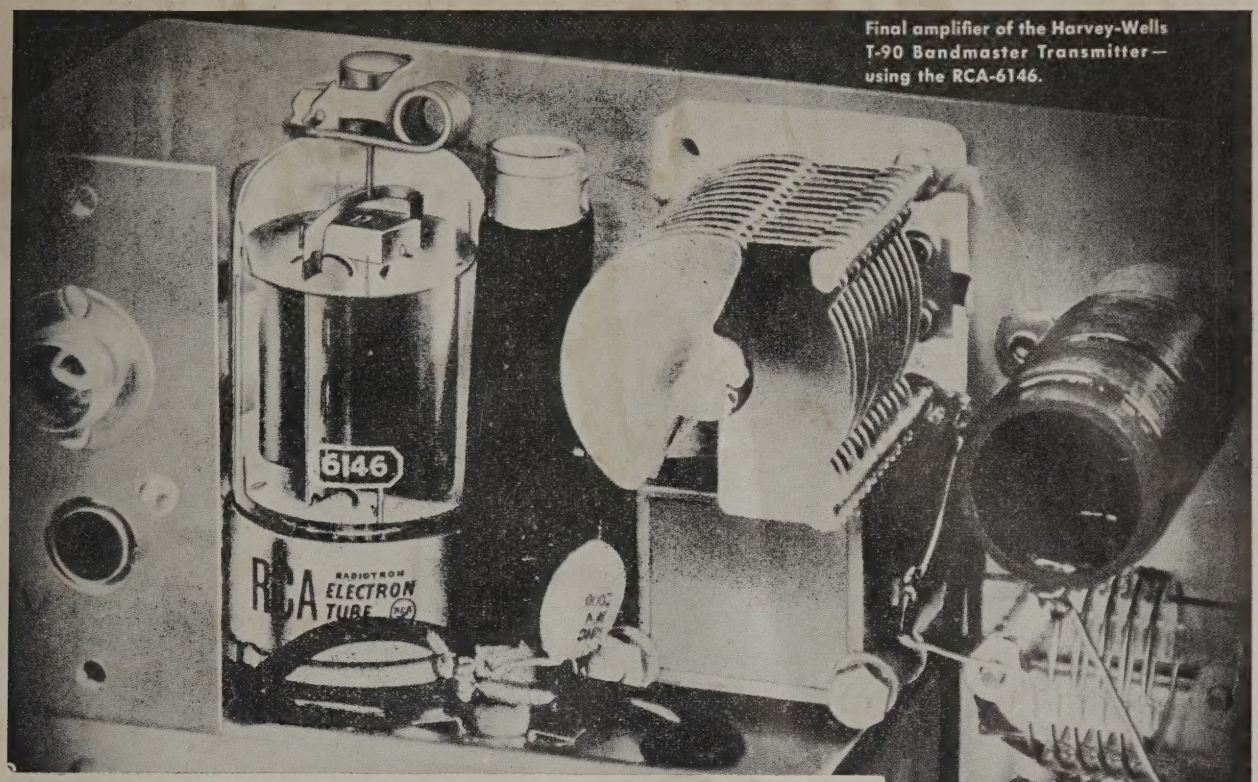
PUBLIC DEMAND
INCREASING DAILY
due to consistent
PRESS & RADIO ADVERTISING

DISPLAY ATLAS LAMPS
PROMINENTLY IN YOUR WINDOW
AND TIE UP WITH THIS PUBLICITY DRIVE

Thorn

New Zealand Distributors:

K. SIMPSON LTD., P.O. Box 2498, Auckland
ARNOLD & WRIGHT LTD., P.O. Box 2253, Auckland
and P.O. Box 6198, Wellington
EGLEY ELECTRICAL CO. P.O. Box 765, Wellington
ZONTILIER FLUORESCENT
LIGHTING CO. LTD., P.O. Box 5030, Wellington
THOMAS HYDE LTD. P.O. Box 503, Christchurch



Final amplifier of the Harvey-Wells T-90 Bandmaster Transmitter—using the RCA-6146.

Leading Amateur Designs

...USE RCA TUBES

You are looking at the business end of a Harvey-Wells T-90 Transmitter. In this "final" an RCA-6146 beam power tube delivers the signal punch that gives this transmitter its reputation for ability to "get out."

Here's why RCA high-perveance beam power tubes, like the 6146, are preferred by leading designers of amateur and commercial transmitters.

RCA beam power tubes make it practical to use fewer components, fewer tuning controls—*fewer stages*. They lend themselves to bandswitching circuits—take full plate input with smaller drivers (a big help in reducing TVI). RCA beam power tubes give you the power you want *at lower plate voltages*.

RCA High-Perveance Beam Power Tubes are available at your RCA Tube Distributor—for amateur transmitters having input-power ratings up to a "gallon." For technical data on any specific beam power tube type including the 6146, writ

SOLE NEW ZEALAND DISTRIBUTORS:

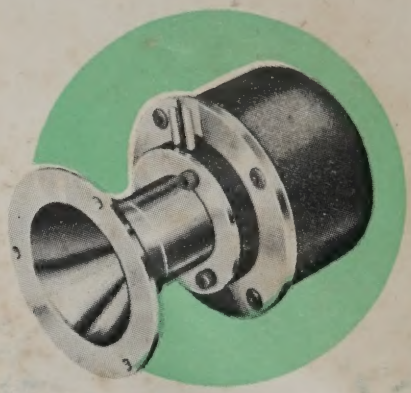
AMALGAMATED WIRELESS (Australasia) LIMITED

P.O. BOX 830, WELLINGTON P.O. BOX 1363, AUCKLAND
P.O. BOX 2084, CHRISTCHURCH

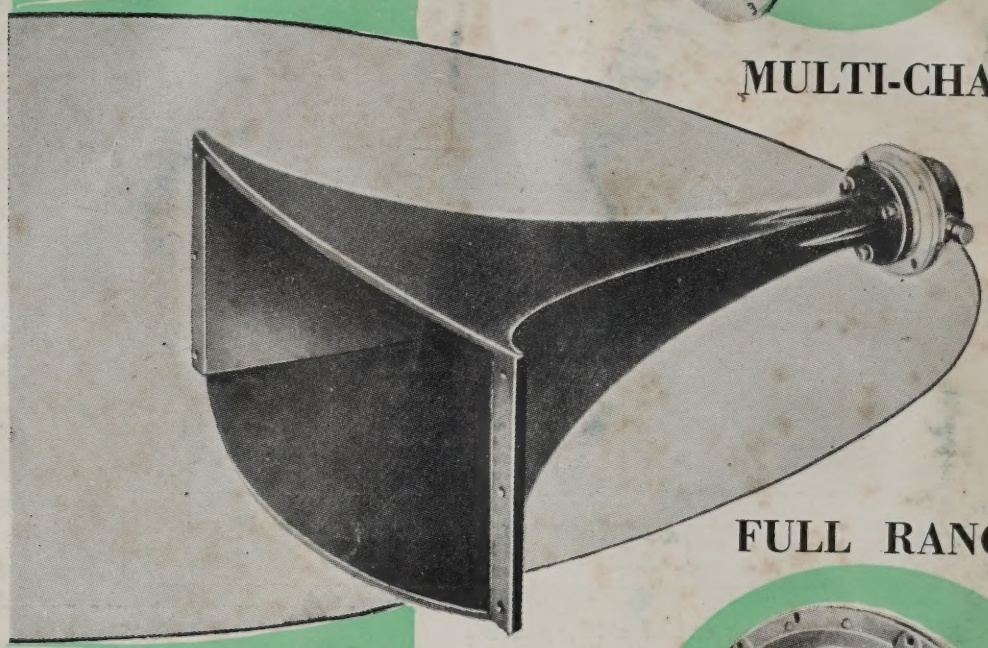
BEAM POWER TUBE RCA-6146

90 watts ICAS input on CW; 67.5 watts on 'phone. Full input to 60 Mc. Reduced input up to 175 Mc.

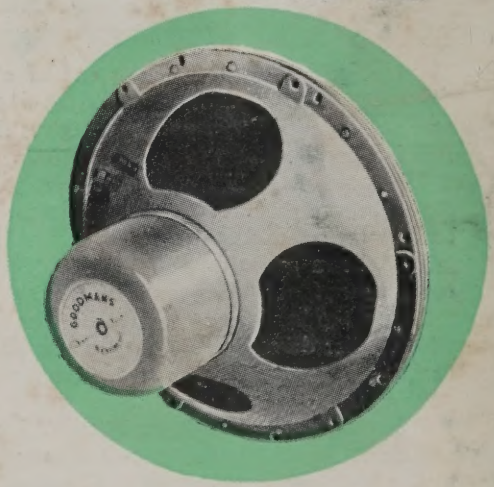
Goodmans



MULTI-CHANNEL



FULL RANGE



Loudspeaker Systems

TURNBULL & JONES LTD.

AUCKLAND WELLINGTON CHRISTCHURCH DUNEDIN
HAMILTON PALMERSTON NORTH NELSON and INVERCARGILL